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NEW ZEALAND JOURNAL OF Agriculture

FEBRUARY - 1951

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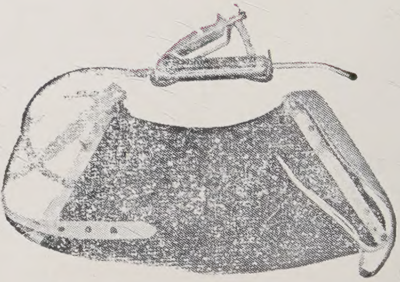

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Volume 82
Number 2
February 15,
1951.
(Established 1910)

NEW ZEALAND JOURNAL OF Agriculture

Published by
Direction
of
Hon. K. J. Holyoake,
Minister of Agriculture.

This Month's Cover

On many areas of intensively farmed land in high-rainfall districts in New Zealand grass in some form is almost the sole fodder for stock. All-grass farming depends primarily on efficient management of high-producing, permanent pastures and the saving of adequate quantities of good-quality hay and silage. This month's cover, which has been reproduced from a colour photograph by Atkinson and Finney, shows workers taking a meal break during haymaking on a farm at Opotiki. The flats around Opotiki are used largely for dairy farming and in the past season the dairy factory at Opotiki produced 3103 tons of butter and 345 tons of buttermilk powder.

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SUBSCRIPTION RATES

The "Journal" is issued monthly. The subscription within New Zealand is 2s. 6d. a year; the overseas subscription is 5s. The "Journal" may be ordered from any bookseller or newsagent, or direct from any office of the Department of Agriculture. Individual copies are available from Publications Section, P.O. Box 3004, Wellington, at 3d. a copy, post free.

Subscription inquiries (preferably accompanied by the address cut from a recent "Journal" envelope) should be sent to the nearest office of the Department of Agriculture.

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All correspondence relating to the "Journal" should be addressed to the Editor, "The New Zealand Journal of Agriculture", P.O. Box 3004, Wellington.

REGISTERED AT THE G.P.O., WELLINGTON, AS A MAGAZINE.

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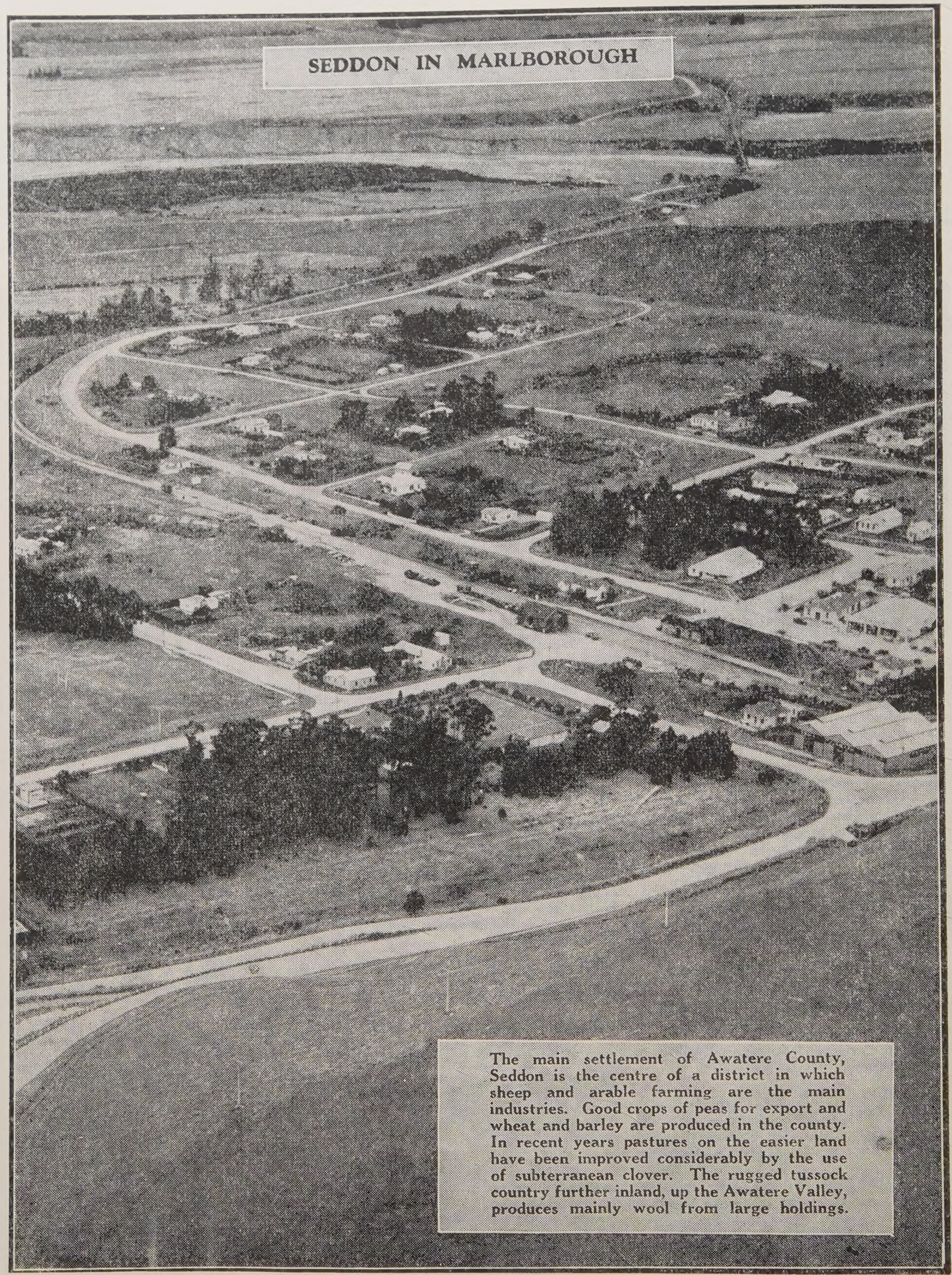
SEDDON IN MARLBOROUGH



The main settlement of Awatere County, Seddon is the centre of a district in which sheep and arable farming are the main industries. Good crops of peas for export and wheat and barley are produced in the county. In recent years pastures on the easier land have been improved considerably by the use of subterranean clover. The rugged tussock country further inland, up the Awatere Valley, produces mainly wool from large holdings.

[*V. C. Browne photo.*

Supplies of Fertilisers for 1951

A REDUCED allocation of sulphur to New Zealand from the United States has necessitated decisions affecting our fertiliser manufacturing industry which I hope will be accepted in good spirit by manufacturers and farmers. The standard mixtures which have been formulated, in preference to rationing, to eke out sulphur supplies, which would be insufficient to enable the manufacture of our requirements of straight superphosphate, should prove fully satisfactory to farmers and their use will not necessitate any increases in the amounts applied.

There is no source of supply of sulphur other than the United States which would be satisfactory and economic for use with present equipment at our fertiliser works, and the minor deposits in New Zealand are in places and in quantities which prohibit commercial exploitation. The above-ground stockpile of sulphur in the United States has diminished considerably since 1948 and the use of sulphur there has had to be restricted. Domestic consumers in the United States have been rationed and exports have been curtailed. New Zealanders, therefore, are not alone in facing a reduced ration. Our allocation from the United States for the first quarter (January to March) of this year is 13,125 tons. There is no indication at present of the quantities of future allocations, but the importation of sulphur to New Zealand this year is expected to be 52,500 tons. In the meantime allocations necessary to enable works to make sulphuric acid from pyrites instead of elemental sulphur are being considered.

Choice of Rationing or Standard Manure

Our manufacturing programme will thus have to be based on the figure of 52,500 tons plus 10,000 tons from reserve, making 62,500 tons available for the year. There are users of sulphur other than the fertiliser works, and if an allowance of 2500 tons is made for all other purposes, 60,000 tons would be available for fertiliser manufacture. This would provide 516,000 tons of straight superphosphate, which, if used straight, would be insufficient for our requirements and would necessitate rationing.

Alternatively we can increase our fertiliser output if, instead of selling straight superphosphate, we adopt some standard mixture to make the supply go further without unduly affecting its efficiency. These points were considered by a conference of the statutory boards, farming organisations, the fertiliser trade, and others interested. It was realised that there were only two courses open, rationing or the bulking of phosphatic fertilisers with other materials to ensure adequate total supplies. Representatives of farming organisations were solidly against rationing in any form and in favour of the present proposal.

The standard manure adopted is 15cwt. of superphosphate, 2cwt. of ground serpentine rock, and 3cwt. of ground Nauru rock phosphate in each ton. Serpentine superphosphate will contain 15cwt. of superphosphate and 5cwt. of ground serpentine rock per ton. In reverted (basic) superphosphate, carbonate of lime will replace ground serpentine rock. The following standard fertilisers will be available: Standard mix; serpentine superphosphate; reverted (basic) superphosphate; cobaltised standard mix; cobaltised serpentine superphosphate; and cobaltised reverted (basic) superphosphate.

Limited Supplies of Serpentine Rock

Supplies of serpentine rock are limited because of difficulties of labour and transport and considerable overburden which must be removed to get at some deposits. The amount available last year was 48,000 tons. It is hoped to increase this production, but available supplies will be insufficient to meet all demands. Thus, when necessary, manufacturers will have the right to replace serpentine orders with standard mixture.

The production of fertiliser should therefore be about 700,000 tons, compared with the 750,000 tons which had been planned for the year. The standard mixture maintains the phosphoric content at the same level. It will be found that the keeping qualities of the mixtures in storage will be considerably better than those of straight superphosphate. Hill-country farmers whose fertiliser must be stored in dumps for periods may find the standard mixtures a definite improvement on previous fertilisers.

Every effort will be made to import the maximum amount of basic slag and finely ground North African phosphate, but this is dependent on supply conditions outside New Zealand and available shipping for that class of cargo. It is expected that last year's imports of about 60,000 tons of soft North African phosphates and guanos will be maintained this year; basic slag imports from Belgium will probably rise to about 80,000 tons in 1951. Small supplies of basic slag are also coming from Japan.

Difficulties of Transport

Because of the great increase in the demand for fertiliser which has followed rising wool prices, some difficulties are to be expected in transport and availability at peak periods. Works produce throughout the year, but there is a tendency for farmers to rush their orders in during January for autumn topdressing. With the improved keeping qualities of the fertilisers now available, farmers will be assisting themselves by placing their orders as early as possible and taking delivery when convenient to the works.

As a farmer I realise well the difficulties and the disadvantages with which many farmers have to contend in receiving their fertiliser at other than the November-March period. It may well be, however, that the choice is not one between ordering early for delivery when convenient and ordering later for summer delivery, but a choice of ordering early and taking delivery when convenient or getting no fertiliser until the winter.

The decisions I have outlined, which were recommended by the conference I have referred to, were come to only after serious consideration of the supply position and with a real desire to cause the least inconvenience possible to manufacturers and farmers. Reasonable assistance from all those affected will ensure avoidance of irksome rationing and at the same time assure adequate supplies of fertilisers of a quality necessary to maintain the structure of agricultural production and our high level of grassland farming.

K. J. HOLYOAKE, Minister of Agriculture.

CARE OF LIVESTOCK DURING MARCH

Contributed by the Animal Research Division.

DRYING OFF OF DAIRY COWS

TO dry off a dairy cow simply stop milking her. This is quite safe and effective. Before drying off a cow examine the milk from each quarter in a strip cup and if there is any sign of mastitis, treat each affected quarter with 3 tubes of penicillin at 24-hour intervals, injecting the third tube after the last milking. If a quarter affected with mastitis feels lumpy, it is not likely to return to full production, and unless the cow is a very good producer she should be culled.

* * *

CULLING OF EMPTY COWS

A cow should never be culled for sterility without being examined for pregnancy by a veterinary surgeon. Many cows thought to be empty have proved to be in calf when slaughtered at the works. The presence or absence of heat is not an infallible guide in diagnosing pregnancy. Good producers which are empty may be worth keeping, as about 80 per cent. of such cows hold when mated in the following season.

* * *

SLEEPY SICKNESS IN EWES

Sleepy sickness in ewes, which in some seasons causes severe losses in pregnant ewes, is due to a sudden drop in the food supply just before lambing. On many farms the only feasible way of avoiding this is by shutting up pasture in autumn for grazing by the ewes for 3 weeks before lambing. Short-rotation ryegrass is particularly valuable for this purpose, as it continues to grow during winter even in Southland.

* * *

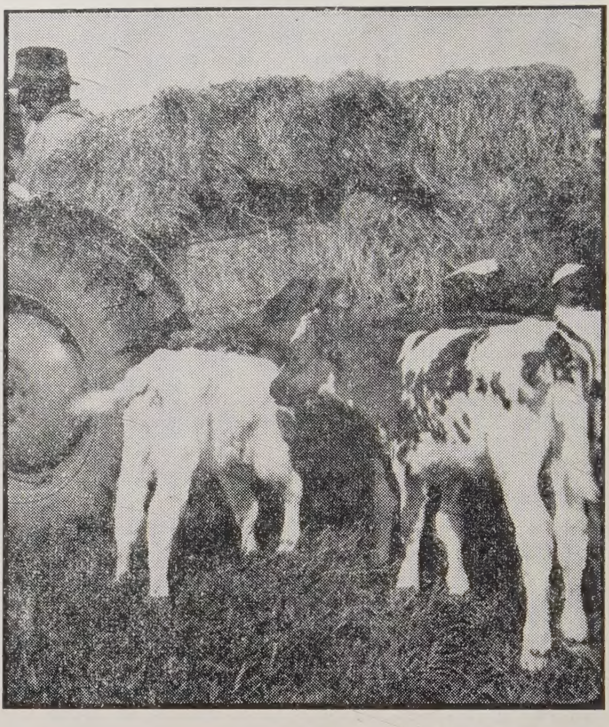
LEAD POISONING IN CATTLE

Many cattle die from lead poisoning every year. As the commonest source of lead on the farm is paint, make sure that old paint tins are burnt or buried, and do not allow cows or calves to lick surfaces from which paint is flaking.

* * *

BLOWFLY STRIKE IN SHEEP

Blowfly strike is likely to occur in showery autumn weather when the humid conditions do not allow rapid drying of the fleece. Constant supervision is necessary to ensure that all cases are treated in the early stages. Shear the wool so as to leave a clean margin all round the strike. Watch carefully for narrow tracks leading to areas some distance from the original strike. Treat with a good non-irritant dressing and be careful to collect and destroy the maggots, as, if these are allowed to fall to the ground, they are capable of hatching into flies.



[*News-photo Service Ltd. photo.*

FEED HAY TO CALVES

Calves should have access to good hay at all times. It is particularly valuable after the first autumn rains and will greatly assist in preventing the severe scouring which sometimes occurs after the grazing of lush, rapidly growing pasture. Make sure that the calves are rotated through the paddocks at intervals of a few days. Set stocking at this time of year is bound to result in scouring, unthriftiness, and some deaths.

* * *

PULPY KIDNEY VACCINATION OF EWES

If losses from pulpy kidney are usually experienced in lambs under 6 weeks of age, they can only be prevented by vaccinating the ewes. If ewes have not been vaccinated in previous years, the first dose should be injected when they are crutched before tupping, and another dose should be injected just before lambing. Ewes which have been vaccinated in previous years require only the pre-lambing injection. Vaccination should be done in temporary yards. Syringes should be boiled before use, and needles should be kept in methylated spirits and wiped and changed each time the syringe is filled. Vaccination of ewes will not be effective in preventing losses in lambs over 6 weeks of age. Where such losses occur it is necessary to vaccinate the lambs themselves.

Milking Goats

IN recent years there has been an increasing interest in the use of goat's milk in New Zealand. In the past goats were kept by a few people who appreciated their qualities, and usually only one or two animals were kept. To develop the production of goat's milk as an industry, milk must be produced under hygienic conditions from high-producing animals fed to the best advantage. This is the first part of an article by A. G. Brash, Veterinarian, and C. P. Harris, Inspector of Stock and Dairies, both of the Department of Agriculture, Christchurch, which deals with all phases of the keeping of milking goats and seeks to dispel misconceptions that may be prevalent about goats and goat's milk. The concluding part of the article will appear in next month's "Journal".

[*Green and Hahn Ltd. photo.*

Goats at pasture on a goat farm near Christchurch.

FEW people realise the extent to which the milking goat has been developed. In relation to her size she produces a greater quantity of human food than any other domestic animal; a good milking goat is quite capable of producing her own weight of milk in less than a fortnight.

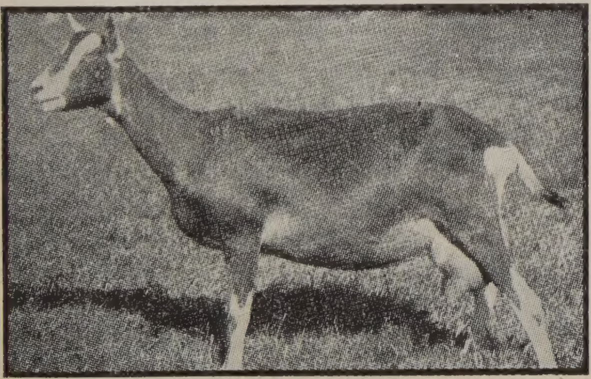
The value of goat's milk, especially for the feeding of infants and children where there has been an unfavourable reaction to cow's milk, has been proved beyond doubt.

This, together with the ease with which goats can be kept and their comparative freedom from disease, accounts for most of their popularity. The demand for goat's milk has brought about the development of some commercial herds, but these are still too few to produce the amount required. It may also make desirable the inclusion in the near future of goat's milk under the Dairy (Milk Supply) Regulation, 1939, of the Dairy Industry Act. This will ensure that the milk is produced and handled under the same standards of hygiene as cow's milk for town supply.

Breeds

There are many goats in New Zealand, but they are of mixed types and generally inferior as milkers. Of the better types those showing Saanen or Toggenburg characteristics predominate. Milk goats are usually short haired and their colour varies with the breed. As in dairy cows good breeding is important for milk production, and milk recording is essential both for pedigree and commercial producers. Saanen and Toggenburg goats—both Swiss types—have been bred especially for abundant production of a high-quality milk which is entirely free from taint. Pedigree goats of both breeds are available in New Zealand, although in short supply, and imported animals are being used by breeders to improve their stock. The Saanen is by far the more popular breed.

Saanen: The Saanen is pure white or pale biscuit coloured. It is an Alpine type with upright ears giving it an alert, deer-like appearance. The dairy conformation is especially well developed. The hair is short and fine, sometimes with a fringe of longer hair along the back and down the hindquarters. It is usually hornless, but horns are not uncommon.

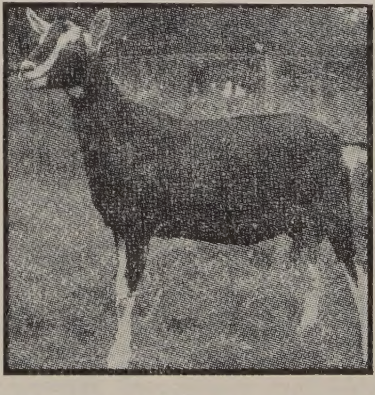


[*From "The Modern Dairy Goat", by J. and H. Shields.*

A British Toggenburg goat.

Toggenburg: The Toggenburg is another Alpine type with erect ears. The colour varies from a silver fawn, through all the shades of drab and brown, to dark chocolate. White markings occur as bars down each side of the face from above the eyes to the muzzle, on the edges and tips of the ears, on the rump, and on or about the tail. The legs are white from the knees and hocks downward. The hair is usually short, but as in the Saanen, may be longer along the back and down the hindquarters. The breed is hornless, although a goat with horns is seen occasionally.

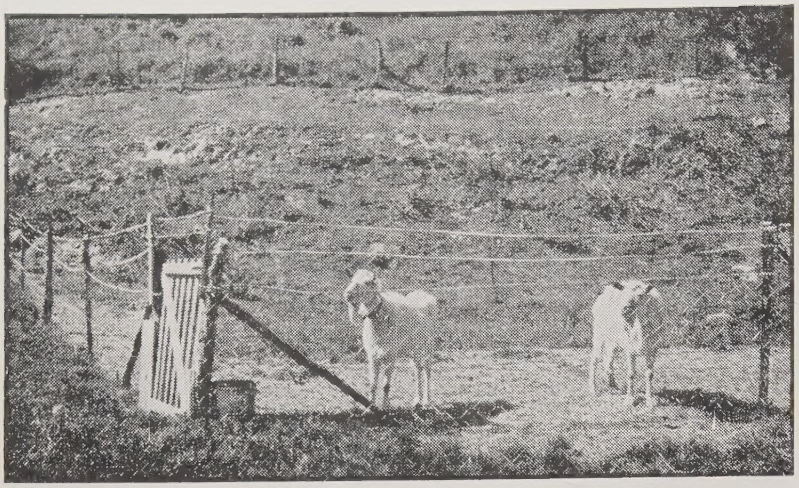
British Alpine: Goats of this breed are alert and resemble fairly closely the Saanen in general conformation. They are black or rusty black with the same white markings as the Toggenburg. The hair is short. They are usually hornless.



[*From "The Modern Dairy Goat", by J. and H. Shields.*

A British Alpine goatling.

BREEDING OF MILKING GOATS



[*Green and Hahn Ltd. photo.*

Bucks must be securely fenced in a separate run.

Anglo-Nubian: This is an Oriental type which may be any colour with no uniform pattern. It is lop-eared. The outline of the face is convex, the forehead being especially prominent. The Nubian, which is a large goat and carries more flesh than the Swiss breeds, is also considered a hornless breed. It gives rich milk, but not in quantity. Tassels are seldom present.

Points of a Good Milking Goat

In general conformation all goats bred for milk production are similar. The breed characteristics in which they differ are mainly colour, shape of head and ears, and to some extent size and length of leg and coat. In conformation Toggenburg, Saanen, and British Alpine goats are identical.

To have milk-producing qualities a doe must have a well-developed body; the goat should be well grown, standing well on her feet, and with legs placed squarely under the body. The head should be feminine and the neck long and slim with or without tassels. Absence of horns is preferred, although their presence or absence has no bearing on milk production. The so-called wedge shape of the dairy cow is clearly defined in a good milk doe. The wedge is seen both from the side view from the neck to the udder and from above from the neck and withers to the hip bones. Good depth of body with well-sprung ribs is important Any marked dip behind the withers or shoulders is undesirable. The back should be fairly level from the shoulders to the hips and then drop slightly to the tail. The thighs need to be thin, leaving plenty of room for the udder.

The udder should be round or globular and carried well under the body, to which it should be attached over a large area. A pendulous udder or one that is "split" between the halves is not desirable. The udder must not be fleshy; just after being milked it should have a collapsed appearance and soft texture. The teats should be of moderate size and should point downward and slightly forward. They should be quite distinct from the udder; the type of udder of which it is difficult to say where the udder ends and the teats start is unsatisfactory.

In general appearance the goat should be alert and active, with good health indicated by a soft, pliable skin and silky hair. The doe should be truly feminine with absence of coarseness and should possess a mild temperament. Good conformation should give an all-over appearance of quality.

The goat has 8 front teeth on the lower jaw, which should meet the pad of the upper jaw, and teeth may be used as a guide to age. A kid under 1 year has 8 small milk teeth; by about the fourteenth month the central pair of these will have been replaced by the large adult teeth. Two more milk teeth are replaced during each of the third, fourth, and fifth years, so that a goat with a "full mouth" will be over 4 years old.

The Buck

To make progress in breeding great care should be exercised in selecting the buck; good bucks like good bulls are scarce. Select a buck from a high-producing doe and a persistent milker. Nothing in breeding is more important than evidence that the entire family to which the sire belongs is especially good in performance and in conformation. Only a purebred buck should be used and once he has proved to be leaving good stock he should be used as long as possible.

The buck should be a vigorous type with strong masculine appearance and good conformation and breed character. Good depth of body is one of the most important considerations. Most breeders prefer bucks that are naturally hornless. Thinness is no objection if the buck is healthy and a good feeder. A buck is seldom in good flesh, especially during the breeding season.

Breeding

Age to breed: As a rule young does should not be bred until they are 15 to 18 months old. Thus doe kids born during spring should be bred the second autumn after birth. To obtain a milk supply during the entire year it would be necessary to breed for both autumn and spring kidding; in such cases young, well-grown does may be bred when 12 to 15 months of age. The goat if well nourished may reach sexual maturity at 4 to 5 months old. Early mating is not desirable and often results in stunted growth. Does have been known to kid when less than 9 months old.

Male kids are capable of giving service at 3 months. Young bucks may be put to service at from 6 to 10 months, but they should not be used to excess in their first season; a dozen services widely spaced is ample.

Mating: The natural breeding season is autumn. With mating extending from the end of February to the end of July kids would be born from July to December, but goats have been known to breed at any time of the year. Where goat dairies are operated breeding will be encouraged over as wide a season as possible to provide a continuity of milk supply. This, however, is one of the major difficulties of goat breeding.

The gestation period for a goat is approximately 150 days, but may extend from 140 to 156 days.

Oestrus or heat periods: Does come in heat regularly between March and August, after which only an occasional doe can be bred. The oestrus cycle is usually from 17 to 21 days, but a shorter cycle is not uncommon. Does may remain in season from 1 to 3 days, the shorter period being more common at the beginning or end of the season. It may be very difficult to detect oestrus in some does and they may then be allowed to run with the male for a time. The usual signs are restlessness, switching of the tail, drop in milk yield, continuous bleating, and swelling and redness of the vulva. The period of oestrus at the beginning of the breeding season may be short, in some cases only a few hours. Does coming in heat in the off season may show only one of the usual signs.

Pregnancy: The best indication that the doe is in kid is the cessation of the oestrus or heat periods, but a temporary increase in milk yield is also considered to be a sign of successful mating. During the first 3 months of pregnancy there is little alteration in the shape of the in-kid does. The head of the foetus can sometimes be felt at from 6 to 8 weeks. The appearance may be deceptive in an old goat or in a young goat that is going to have only one kid.

Milk goats are very prolific, the usual number of kids for mature goats being two, but frequently there are three, and four is not rare. The tendency to produce four kids is hereditary. It is not desirable and should be guarded against when access to breeding records is possible.

The care of the doe during pregnancy will have a big influence on the vigour of the kids at birth. Does need to be well fed, allowed plenty of exercise, and to be protected from rain and cold weather.

Parturition or kidding: At this time the doe should be segregated, preferably in a clean stall thinly bedded down with straw. A day or two before kidding a change in the shape of the doe will be noticed. The flanks become more hollow and the swollen area shifts to a lower position. At the same time the udder will begin to swell. A few hours before kidding there is a marked softening of the ligaments at the base of the tail. A white or colourless discharge may now be seen together with restlessness and swelling of the vulva. Straining now starts, followed by appearance and bursting of the water bag and birth of the first kid usually within half an hour. The usual presentation is with the head between the fore feet, but kids are sometimes born hindquarters first, and this is quite normal. Goats seldom require assistance when kidding and it is advisable to avoid interference if possible. The afterbirth, a separate one for each kid, is usually expelled within a few hours. Steps to be taken in a case of retained afterbirth will be discussed in the second portion of this article, in next month's "Journal".

The doe may now be given a drink of a pint of oatmeal gruel to which a dessertspoon of treacle or molasses has been added, followed in 2 or 3 hours with a bran mash. To prepare the mash take ½lb. of bran and 1 teaspoon of salt; over this pour ½ pint of boiling water, cover the mixture with dry bran, and then cover the whole with a lid or cloth cover. The mash is fed when cool and should be made fresh as required.

Hermaphrodism: A hermaphrodite is an animal whose genital organs have the characters of both male and female. There is a hereditary factor for this condition, which appears to be intensified by close breeding. It is also closely associated with polled or hornless animals and horned goats are not affected.

[*Green and Hahn Ltd. photo.*

These Saanen goats are rapidly clearing gorse and broom on this property. Note the good sole of grass in the cleared areas.

Care and Management

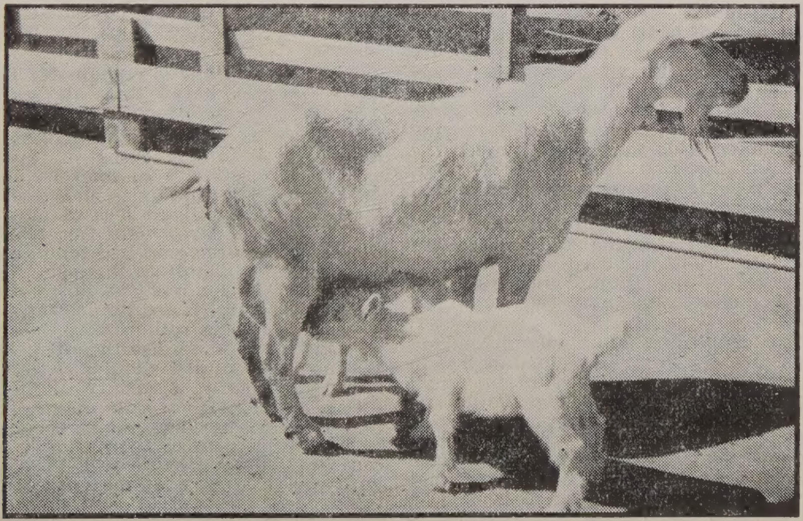
Outdoor management and feeding: As goats are browsing, not grazing, animals, good pasture by itself is not as fully appreciated as it is by the dairy cow. Roughage such as leaves and shrubs and good-quality hay is an essential item of their diet. Goats relish an immense variety of foods. They will strip the foliage off broom and gorse and eventually destroy it, as shown by the illustration on this page. Provided they are fenced in on the area, they will also clean up blackberry. They are, however, fastidious and decline to eat food that has been soiled. Hay must be fed from a rack and hedge clippings and similar material should be tied in bundles where the goat can reach them. Variation of diet is essential, as goats tend to have marked likes and dislikes which vary with individuals. Household scraps, particularly bread, vegetables, and fruit peelings, are useful additional foodstuffs often greatly appreciated.

It must not be concluded from the above remarks that the type of feed the goat obtains when browsing is sufficient for milk production. Hand feeding with good-quality roughage such as lucerne hay and also concentrates is essential if the doe is to produce to her capacity. Good quality is very necessary in the supplementary feeds to make up for the lack of quality in those readily taken when browsing.

Pasture: Good pasture is an excellent feed for goats, but hay and some concentrates should always be fed with it. Palatability can best be maintained if pasture is fed in small units, and the electric fence is useful in this respect. Three wires are needed on an electric fence for goats. (Ordinary fences should preferably have 8 wires, and sloping wooden strainers should not be used, as goats are nimble and can use them as means of egress.) This type of management will also help reduce worm infestation.

Roughages: Does in milk should be given all the roughage, that is, hay or chaff, that they will eat. The best roughage is lucerne or clover hay or lucerne chaff. If this is not available, oaten chaff can be used. The average consumption of hay or chaff per day is about 3 to 4lb. This would be reduced to 2lb. if about 3lb. of silage, root crops, or leafy vegetables are available. Swedes, mangolds, and sugar beet are nearly always appreciated; carrots sometimes, but turnips seldom. Potatoes should preferably be cooked. If silage is fed, a little should be fed at first, and the amount gradually increased. Care should be taken not to introduce it too freely, as dietetic disturbance will result.

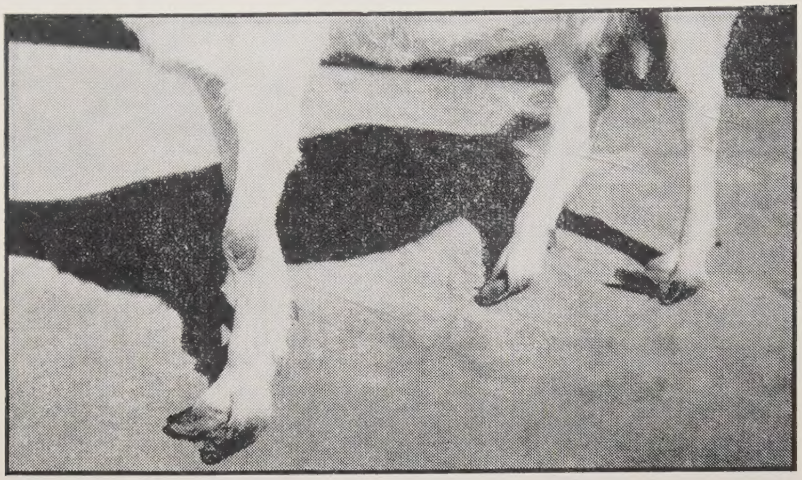
Concentrates: Roughage must be supplemented with concentrates such as crushed oats, maize, or barley or bran, pollard, oatmeal, or linseed meal.



[*Green and Hahn Ltd. photo.*

Kids may be reared on the doe or hand fed.

MANAGEMENT OF MILKING GOATS



[*Green and Hahn Ltd. photo.*

Goats' feet should not be allowed to become overgrown. Regular trimming will keep them in good condition.

The amount of concentrates fed will depend mainly on the milk production and the type and quantity of other feed available. Each doe should be studied if the best results are to be obtained. Where no grazing is available concentrate mixtures should be fed at the rate of 1lb. per day for every quart of milk produced. When the does are on pasture 1 to 2lb. of concentrates daily would be an average ration, with hay available in whatever quantity they will eat. The feeding of concentrates is well worth the extra cost, as it will considerably increase the milk yield and also the quality of the milk.

The type of concentrates necessary will vary with the type of roughage available. With lucerne hay or lucerne chaff a mixture with comparatively low protein content may be used, but where oaten chaff is fed a comparatively high protein mixture is needed. Of the grains, oats are best, but maize is also good. A combination of grains may be used, preferably fed separately in the dish or trough, and bran and pollard may be mixed.

Examples of suitable concentrate mixtures (given in parts by weight) for feeding with lucerne hay or chaff are:—

1. Crushed grain (oats, maize, or barley), 1; bran or pollard, 3.
2. Crushed grain (as above), 5; linseed meal, 1.
3. Crushed grain (as above), 5; linseed meal, 1; bran or pollard, 2.

Examples of suitable mixtures (given in parts by weight) for feeding with oaten hay or oaten chaff are:—

1. Crushed grain (oats, maize, or barley), 2; linseed meal, 2.
2. Crushed grain (as above), 1; bran, 1; linseed meal, 1.

Concentrates should always be fed from clean troughs or dishes. They are usually fed dry, but mashes are welcomed if goats are used to them. Molasses is a useful adjunct to feeding, and a mash may be made with watered molasses, allowing about a tablespoon of molasses for each goat.

Water: A plentiful supply of clean water is essential at all times. Milking goats on dry rations will drink a considerable amount, especially in warm weather. Shortage of water will lead to a drop in the milk production.

Mineral lick: A lick of 2 parts of bone flour and 1 part of coarse salt in boxes protected from the weather should be available. Such a lick is especially necessary where no grazing is provided.

Tethering: Tethering of goats is not recommended, but it may be necessary where only one or two are kept and fences are not suitable. Goats need exercise and fresh feed and do better if running free. Where tethering is adopted the rope should be as long as possible, about 20ft., with a swivel where it is attached to the collar to prevent twisting. Fix the rope over the stake with a loop so that it can revolve freely. A better method is to attach the rope by a sliding ring to a wire running between two posts.

Rearing of kids: Kids may be reared on the doe or hand fed. Kids that are allowed to suckle their dams not only make good growth but require very little attention compared with those raised by hand. Where hand rearing is adopted kids may be left with the doe for the first two or three days, and this is recommended. Alternatively they are not permitted to suckle their mother and the colostrum is milked from the doe and fed to the kids through an ordinary infant's bottle. The doe should not be milked right out for the first two or three days.

The usual method of hand rearing kids is to begin with a feeding bottle and gradually teach them to drink from a pail or dish. There should not be undue haste in removing the kids from the bottle. When this stage is reached see that they do not gulp the milk down too rapidly, as this may lead to digestive troubles.

The milk should be fed warm four times a day until the kids are a month old, and then twice a day. Feeding bottles, dishes, and other utensils must be kept thoroughly clean. The amount of milk required daily by kids until they begin to graze is about 1½ to 2 pints. Although goat's milk is preferable, kids can be raised satisfactorily on whole cow's milk. The milk should be from tuberculin-tested cows.

A method of rearing sometimes used is to allow the kids to suckle the does for the first 6 weeks. The kids are then shut up separately at night. The does are milked by hand in the morning and the kids allowed to run with their mothers during the day.

When the kids are a month old they may be given a little calf meal in gradually increased quantities. Either of the following meals is suitable: One part by weight of crushed maize or barley and 1 part of crushed oats; 1 part by weight of crushed maize or barley, 1 part of bran, and 1 part of linseed meal.

Salt (2oz.) and bone flour (4oz.) should be added to each 25lb. of mixture.

Kids may be weaned at from 3 to 4 months, and it is advisable to dose them for worms with phenothiazine at this time. They should be allowed plenty of room for exercise in a well-grassed paddock for preference.

Growth of horns can be prevented with a caustic stick or with a special disbudding iron. Both methods are similar to those used for calves; the red-hot iron method is preferred. Treatment with caustic must be carried out within the first 4 days after birth and with the hot iron between the age of 4 days and 3 weeks. A veterinarian should be consulted for the details of these methods.

Care of the stud buck: A buck from 12 to 18 months of age can be bred to at least 25 does. An adult buck in good condition is capable of mating 100 or more does. Stud bucks should have separate and safe yards and runs and separate housing. Does in season should be served and then removed from the buck. To run the buck with the does may be the easiest way, but for many reasons it is not desirable. Not only do the bucks overwork themselves—one service is usually sufficient—but they contaminate the does with the objectionable odour so often associated with the buck at mating seasons.

The buck alone is responsible for the common belief that all goats smell.

He may be the culprit, directly or indirectly, in many cases of tainted milk. Given plenty of exercise, kept in clean surroundings, and treated kindly, bucks will be less of a problem. With ill treatment or teasing, however, they develop bad temper and can become difficult to manage. Most bucks show a tendency to go off their feed during the breeding season. Although becoming rather thin, they appear to retain their health and vigour, but no opportunity should be lost to tempt them with a variety of food.

Care of feet: Hooves require regular trimming to prevent them becoming overgrown and misshapen. Pare down the outer horny growth until it is level with the sole. A goat that has at any time been subject to laminitis will need to have the hooves trimmed more often.

(To be continued.)

The Importance of Plant Quarantine to Agriculture

By G. A. H. HELSON, Research Superintendent, Horticulture Division, Department of Agriculture, Wellington.

PLANT quarantine includes all those situations in pest and disease control in which, in addition to individual effort and community co-operation, legal restrictions are imposed on the movement of commodities to prevent or delay the establishment of plant pests and diseases in areas where they are not known to occur. These restrictions are based on the premise that economically it is better to undergo considerable inconvenience and initial expense to exclude a pest or disease than to have to control it for an indefinite period.

IN the spread of plant pests and diseases to new localities three different geographical situations may be distinguished—a continent separated from other land by oceans—areas on the same continent separated by pronounced natural barriers, such as high mountains or broad deserts; and areas on the same continent not separated by natural barriers.

New Zealand is in the first category, having a natural barrier, the sea, and plant diseases and pests can spread to the Dominion only through the agency of man. Plant pests and diseases recorded now are very different from those known in the days of early colonisation.

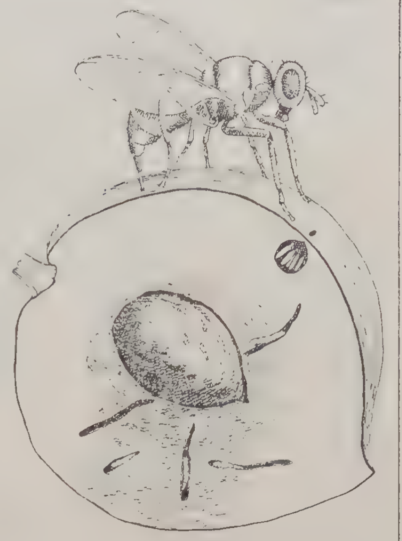
Systems of Plant Quarantine

The four principal systems of plant quarantine are inspection at the destination, inspection and certification at the place of origin, complete embargo, and controlled introduction.

In general, a quarantine cannot be effective if reliance for the detection of pests or diseases is placed solely on inspection of shipments of plants or plant products at either the place of origin or their destination. Additional safeguards necessary consist of complete embargoes against plant products which are likely to carry serious diseases, and treatment or quarantine after arrival of plant products which may carry less serious pests or diseases.

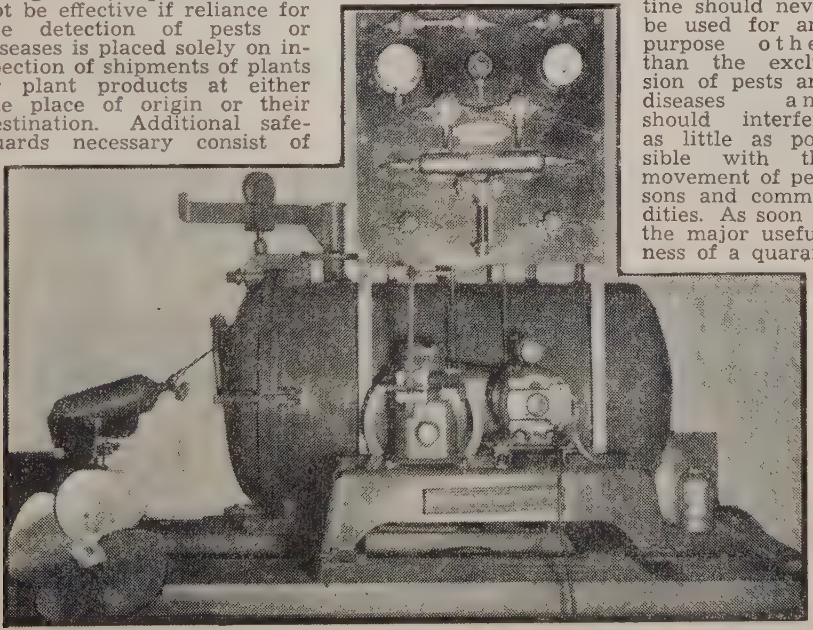
Therefore a plant quarantine, to be effective and justifiable, must provide for the closing of the major avenues of the entrance of the pest or disease and must be maintained by a force sufficient to carry out its provisions. Because of the existence of innumerable species of plant diseases and insects which feed on plants, in practice it is necessary to compromise between exclusion of all insects and diseases, involving a complete cessation of exchange of commodities, and the unrestricted exchange of commodities with extreme risk of introduction of dangerous pests. This compromise must take the form of a programme of controlled exchange with reduced risk.

A plant quarantine should never be used for any purpose other than the exclusion of pests and diseases and should interfere as little as possible with the movement of persons and commodities. As soon as the major usefulness of a quarantine has passed, or if it is evidently no longer effective, it should be rescinded promptly.



[*After Sydney "Sunday Sun".*

The Queensland fruit fly lays eggs which hatch in a few days within the developing fruit.



A vacuum fumigation vault of 10 cub. ft. capacity for the fumigation with methyl bromide of parcels arriving by parcels post and by air.

The failure of a quarantine to prevent incipient establishment of a pest or disease does not exclude the possibility of preventing its permanent establishment, as it may be followed by a successful eradication campaign. Destruction of the last individual pest or pathogenic organism by artificial means is not necessary to bring about eradication. In at least some cases the destruction of most of such organisms results in the completion of the task by Nature.

New Zealand's Problems

In New Zealand plant quarantine is more feasible than in many other countries, because the Dominion is surrounded by oceans which constitute barriers to natural dispersal of pests and diseases. However, the country is vulnerable to the introduction and establishment of pests and diseases through human transport because of the great variety of crops grown, the amount of commerce passing through the sea ports, and the extent of tourist travel.

Under certain conditions plant quarantines may prevent or delay the establishment of new pests or diseases, but the general growth of plant quarantine policy now taking place in New Zealand and other parts of the world may present a serious problem for New Zealand, because this country depends on outside markets. Serious restrictions on the distribution of farm products conceivably may become a more difficult problem for the New Zealand producer to meet than the control of pests and diseases. The maintenance by New Zealand of unfair and unnecessary quarantines would

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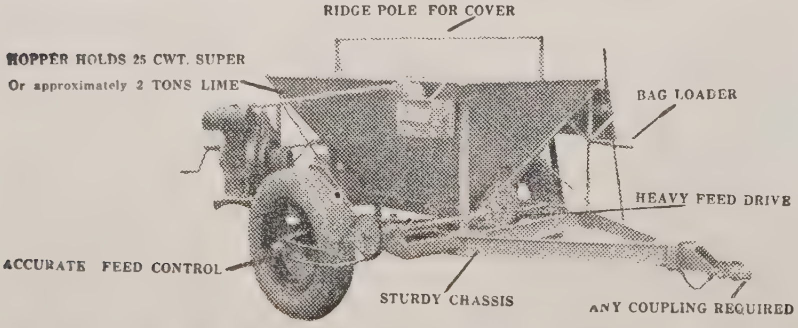

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greatly increase the danger of restrictions being imposed on her products by other countries, so the losses to New Zealand would be just as great from retaliatory measures as from justifiable quarantines established against major or minor pests.

If new pests become established, the likelihood of the introduction of quarantine regulations in other countries against New Zealand's products is very great. Therefore it would be unwise to abandon the principle of quarantine because of the danger that diseases or pests might enter and that other countries would then establish quarantines against New Zealand's products. Maintaining unnecessary or unimportant plant quarantines would be equally unwise because they might produce a similar result. Thus it is essential that New Zealand quarantines be based on sound biological and economic principles and that they be fair to and considerate of other countries.

Air transport and fast surface travel have so reduced the time taken to carry passengers and cargo from one country to another that now it is frequently considerably less than the time required for the completion of the life cycle of many insect pests. This has greatly increased the risk of introduction of many serious pests and plant diseases.

Amendment of Legislation

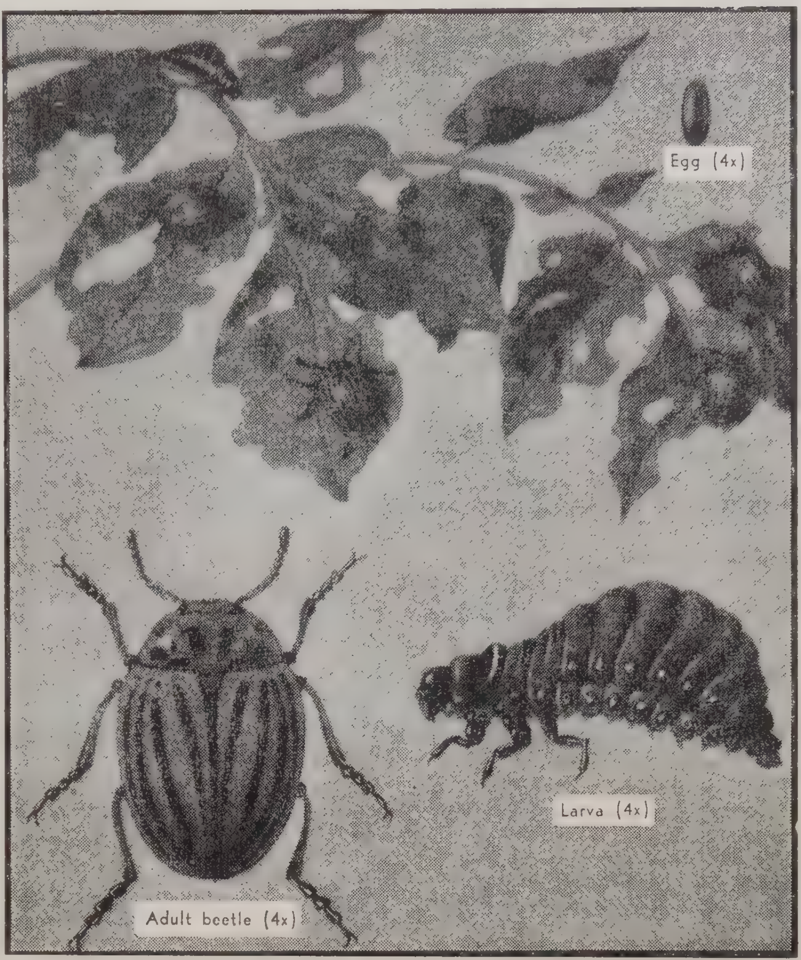
Responsible Governments throughout the world, realising the danger to the agricultural economy of their countries brought about by modern developments, have been revising their quarantine regulations to meet the new situation. The subject of plant quarantine has been raised to the international plane, and a Phytosanitary Convention under the auspices of the United Nations Food and Agriculture Organization has been proposed. Regional conventions have also been held and one for the South Pacific has been convened.

New Zealand became acutely conscious of the inadequacy of her plant quarantine procedure under modern conditions after discussions on this subject at the Seventh Pan-Pacific Science Congress held in New Zealand early in 1949. Since then the existing laws and regulations enforced have been closely studied.

The Orchard and Garden Diseases Act, 1928, which had as its object the control of plant diseases, was amended on various occasions, but its powers were not sufficient to enable the checking of the entry of the more serious diseases and pests occurring in other countries and not recorded in New Zealand. An amending Act to bring the law up to date in plant quarantine procedure was passed in 1950 and new regulations under this Act have been prepared and submitted to interested organisations for consideration.

Pests which could Gain Entry

Examples of pests against which New Zealand previously had a measure of protection in the time taken for their transport from neighbouring countries, but which air travel has now made a danger, are various species of fruit flies and in particular the Oriental fruit fly (*Dacus ferrugineus dorsalis* Hendl.). Some of the many species of fruit flies are quite harmless and feed on flowers; others are of varying degrees of economic importance to agricultural crops. The Oriental fruit fly appears to be the worst known species, because it attacks a very wide range of host plants, including fruit and vegetable plants, and, unlike many other fruit flies which attack only ripe fruit, it will infest immature fruits and vegetables. This pest is a native of Asia and spread across the Pacific from the Mariannas to Hawaii during the Second World War. Large numbers of fruit flies have been captured in lures around the airport in Honolulu. The adult fly can live for long periods and can easily survive the few hours' air travel required to bring it to New Zealand. Apart from the danger of its being carried in the luggage holds of cabins of aircraft, it could be introduced on leis and sprays of flowers as well as on fruits and vegetables of all kinds.



[*After Plantenziektenkundige Dienst, Wageningen.*

The Colorado potato beetle is a dangerous pest native to the U.S.A. and now rampant in many European countries. Plant quarantine is designed to prevent the entry of such pests into New Zealand, particularly by air.

The Oriental fruit fly does not occur in the South Pacific, New Zealand, or Australia and every effort is being made to prevent its spread southward. The United States of America is so concerned that the insect should not be accidentally introduced into the mainland that it insists that every aircraft eastward bound from Honolulu, with all its cargo and passengers' luggage, be inspected and fumigated before leaving. By arrangement between the Governments of the United States, Australia, and New Zealand a similar inspection and fumigation service is being brought into operation by officers of the Foreign Quarantine Service of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, at Honolulu for aircraft southward bound for Australia and New Zealand.

In Australia the most serious fruit fly is the Queensland species (*Dacus ferrugineus tyroni* Frogg.), which is very closely related to but biologically distinct from the Oriental fruit fly. On the east coast of Australia this

PLANT QUARANTINE . . .

species completely ousted the Mediterranean fruit fly (*Ceratitis capitata* Wied.), which has not been seen since 1931. Apparently the female of the Queensland species deposits its eggs in the punctures made by the female of the Mediterranean species when laying in the skin of fruit, and the maggots of the Queensland species destroy those of the Mediterranean species. The Queensland fruit fly could readily be transported to New Zealand by air, and this danger has become more important because of recent changes in the habit of the fly. Australia is also concerned about these changes in habit, because the fly is extending its habitat steadily southward into localities hitherto considered too cold, where it has adapted itself and become established. Interstate plant quarantines have recently been revised and made more stringent in an endeavour to check the spread of this pest.

The Argentine ant (*Iridomyrmex humilis* Mayr.) is another pest which could readily be introduced from Australia by air, especially with nursery stock or pot plants. Even the Colorado potato beetle (*Leptinotarsa decemlineata* Say.) could survive an air passage from the mainland of the United States and gain a hold in New Zealand.

All aircraft arriving in New Zealand from overseas are now being met by Plant Quarantine Officers of the Department of Agriculture, and the list of pests intercepted by this service is steadily mounting. A recent example was the interception of living adults of the Australian Christmas or king beetle (*Anoplognathus viridiaeneus* Dom.), a member of the grassgrub family, which arrived by flying-boat in November, 1950.

Greater Vigilance Necessary

The list of serious pests which could reach New Zealand by air could be extended greatly, but the examples given show how serious the position has become and the necessity for greater vigilance. Quick identification of a pest or disease is essential so that, if incipient infestations do pass the port inspection and appear in the country, immediate eradication programmes can be initiated.

The value of prompt identification was shown when a very large consignment of nursery stock was imported in January, 1950. Subsequently two major pests and one plant disease appeared in the field. One of the pests, the apple leaf curling midge (*Dasyneura mali* Kieffer), appeared at points as far apart as Auckland and Invercargill; it is a serious pest of apple orchards. The other pest, the European tent caterpillar (*Malacosoma neustria* L.), appeared at only one point; it is a serious pest which defoliates shade and orchard trees. It is hoped that prompt eradication programmes have stamped out these incipient infestations and prevented two more names from being added to the list of economic pests in New Zealand. The disease was a rust of birches and larches (*Melansoridum betulinum* Tull. (Kleb)); it also appeared at only one place and it is hoped that eradication measures have stamped out this incipient infestation as well.

Nests of wasps have been found in cases of electric motors arriving from overseas, and second-hand aircraft themselves may bring undesirable emigrants.

Soil around living plant material has been another important means of carrying serious pests and diseases. Some of the pests which might be introduced in this way include the golden eel worm of potato (*Heterodera rostochiensis* Woll.), the Argentine ant, citrus thrips (*Scirtothrips citri* Moulton), the Colorado potato beetle, the Japanese beetle (*Popillia japonica*), the Mediterranean fruit fly, the Oriental fruit fly, the Oriental fruit moth (*Cydia molesta* Busk.), phylloxera (*Phylloxera vitifoliae* Fitch), the raspberry beetle (*Byturus tomentosus* Fab.), the Rutherglen bug (*Nysius vinitor* Berg.), and the cattle tick (*Margaropus annulatus* Say.). Even bacterial and fungal diseases such as potato ring rot (*Corynebacterium sepedonicum* S.K.) may infect soil and so be transported from one country to another. Therefore no plant material should be packed in soil. Suitable packing material includes sphagnum, sawdust, woodwool, and vermiculite.

Fumigation Service

The New Zealand Government, recognising the serious danger to which an insufficient quarantine service could expose the farm industries of the country, has authorised the establishment of vacuum and atmospheric fumigation vaults at the main ports of entry, methyl bromide being used as a fumigant. The toxic hazard with this gas is less than that associated with hydrogen cyanide, but methyl bromide is sufficiently toxic to require very careful precautions. Therefore all operators of equipment using methyl bromide will be trained and must hold a certificate qualifying them to operate the fumigation vaults.

A number of small vacuum fumigation vaults of 10 cub. ft. capacity for treatment of packets and parcels arriving by parcels post and air have been completed and are in operation at Auckland, Wellington, Christchurch, and Dunedin. It is proposed to install larger vacuum fumigation plants at Auckland and Wellington and to increase the capacity of the fumigation vault at Christchurch.

Co-operation Needed

To be successful, plant quarantine requires the fullest public support and the co-operation of every traveller and importer. Importers, whether commercial or private, can assist by making sure that every consignment of plant material is accompanied by a health certificate and that the nearest Plant Quarantine Officer of the Department of Agriculture is notified well in advance of the arrival of highly perishable material such as bud wood so that the material may be received, treated, and dispatched as quickly as practicable. By acquainting themselves with the regulations before importing plant material importers can avoid unnecessary disappointment and delays.

◆

DAIRY PRODUCE GRADED FOR EXPORT

THE following figures showing quantities of dairy produce graded for export during December and for the 5 months ended December 31, 1950, with comparative figures for the same month and 5-monthly period of 1949, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER—

Period		Tons			Tons
	Creamery	Whey	Total	Percentage inc. or dec.	Total in store at end of mth.
December, 1950	18,104	340	18,444	—	34,309
December, 1949	22,194	403	22,597	—	47,394
Increase or decrease	—4,090	—63	—4,153	—18.378	—13,085
For 5 months ended 31/12/50	83,989	1,536	85,525	—	—
For 5 months ended 31/12/49	90,882	1,553	92,435	—	—
Increase or decrease	—6,893	—17	—6,910	—7.475	—

CHEESE—

Period		Tons			Tons
	White	Coloured	Total	Percentage inc. or dec.	Total in store at end of mth.
December, 1950	13,833	84	13,917	—	21,442
December, 1949	11,947	3,405	15,352	—	24,048
Increase or decrease	+1,886	—3,321	—1,435	—9.347	—2,606
For 5 months ended 31/12/50	49,506	1,329	50,835	—	—
For 5 months ended 31/12/49	39,806	11,306	51,112	—	—
Increase or decrease	+9,700	—9,977	—277	—0.541	—

If these figures are converted into butterfat equivalent, there is a decrease of 6.111 per cent. in butterfat graded for the 5 months as compared with the corresponding period of the preceding season. It should be noted that the above figures refer only to butter and cheeese graded for export, and that owing to diversions which take place from time to time, they are not necessarily a true indication of production trends.

CHANGES OF ADDRESS OF "JOURNAL" SUBSCRIBERS

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HEADING PHOTOGRAPH: Part of a high-country run in Canterbury. From such runs comes the finer wool of the province. National Publicity Studios photo.

FARMING IN CANTERBURY

THE three previous articles in this series have described the development of farming in Canterbury from 1850 to 1920. This article, which has been compiled by P. R. Stephens, Assistant Investigating Officer, Department of Agriculture, Wellington, from notes supplied by officers of the Extension Division, concludes the series and brings the story of Canterbury farms up to the present day.

THIS article could not possibly deal in detail with the events and changes since 1914—war, depression, war, and post-war readjustments. The effects of wartime shortages and inflationary price rises on the one hand and depression with its attendant features of unemployment and insecurity on the other have been much the same in every community. It would be sufficient to say that the Canterbury farmer has adapted himself as well as any other and during the last 20 years he has been able to make significant technical advances, with the result that today he is probably better prepared than ever to meet anything that the future may hold.

Wartime Assistance to Wheat Growers

During the First World War the bulk purchase of meat and wool was introduced and large-scale assistance was first given to the wheat grower. Alarm was felt at the outbreak of war in 1914 about future wheat supplies, and after prices had begun to rise quickly the Government made an ineffective attempt to impose a form of price control. Better harvests removed the danger for a while, but in 1916 the Government introduced a guaranteed price and fixed the selling price for wheat, flour, and bread. By this time it had the power to do all these things, unlike the earlier occasion when it had no means of imposing its regulation. The guaranteed price maintained local production higher than it might otherwise have been, but it could not prevent the area in wheat falling to a low level in 1919-20, when meat prices made fattening of stock more profitable.

Canterbury's contribution to British needs during the war was an impressive one. Between 1915 and 1920 about 2,198,000 carcasses of mutton and 6,060,000 carcasses of lamb were exported under the British Government's bulk-purchase scheme, and between 1916 and 1920 about 400,000 bales of wool were valued under the commandeer system instituted by the New Zealand Government.

Protection for Wheat Industry

After the war it was clear that the wheat industry would continue to need some form of protection and over the next 15 years attempts were made to provide it in a manner which would maintain local production and at the same time not impose too heavy a burden on consumers. The Government guarantee ceased at the beginning of 1923, and between then and 1927 an attempt was made to protect the industry by a straight-out tariff. This proved ineffective, and in 1927 the controversial sliding scale of duties was introduced, designed to protect the grower against low prices overseas and at the same time to protect the consumer from exploitation. At the time the duties were the subject of much controversy, for the wheat farmers alone were singled out for assistance when others had to trust themselves to the ups and downs of the world market. During the depression the duties were lowered, and after the record harvest of 1932-33 a surplus of 2,000,000 bushels was "dumped" abroad, a practice generally frowned on. Since 1936 the import of wheat has been controlled by a Wheat Committee, which also fixes prices.

Soldier Settlement

After the post-war boom had run its course meat and wool prices slumped in 1921 to very low levels, half-bred wool selling at below 9d. per pound and prime ewes at Addington at less than £1 each. With the passing of the Meat Export Act in 1922 the marketing of New Zealand meat was at least improved and the wartime stocks of wool were successfully disposed of by the joint organisation British Australia Wool Realization Association Ltd. Wool growers did not form any permanent organisation to deal with marketing until 1944.

The post-war boom in prices was accompanied by perhaps a more extravagant boom in land values. Between the mid-1890's and 1914 land values in Canterbury rose by about 60 per cent.; between 1914 and 1920 they rose by equally as much. The long and painful readjustments that soldier settlers had to make in the years between the wars was caused largely by most of them having to purchase their land at the height of the boom. Dairy farms attracted most speculators, a factor which freed Canterbury of some of the worst excesses, but the annual report of the Canterbury Agricultural and Pastoral Association for 1920 remarked: "In South Canterbury especially rich land has been sold in small blocks at prices up to £95 an acre and the new owners are chiefly going in for dairying".

High prices for land and the limited land available resulted in many soldiers and civilians being placed on holdings that were too small to provide a reasonable standard of living. The land was often not good enough for cropping, and the holdings were too small for grazing. Readjustment of soldier settlers' liabilities was begun as early as 1923, but until the enactment of the mortgage legislation of the depression which culminated after 1936 in the drastic reduction of farmers' liabilities many farmers just managed to struggle along under the burden of rent and interest payments. Even in 1939 it was estimated that 45 per cent. of those Canterbury farmers whose liabilities had been scaled down were still in difficulties.

A more radical approach to the problem of soldier settlers in Canterbury on uneconomic holdings was begun in 1938 by a voluntary scheme of regrouping. Over a period of 4 years 250 holdings were reduced to about 150 of a more economic size.

World-wide Depression

The collapse of prices in the depression is all too well known. In March, 1929, prime ewes were selling at Addington for 27s. 9d. each and in the same year half-bred wool was 17d. per pound; by 1931 the prices were 10s. 9d. and 8¾d. respectively. Meat and wool almost regained their pre-depression level in 1934, but the rise was not maintained and fluctuating prices before the war hindered genuine recovery.

Canterbury farmers reacted to the depression by turning more to arable crops. In 1931 wheat sold for almost the same price as it did in 1929, though the price of everything else had fallen; it is therefore not surprising that the area in wheat was maintained at more than 200,000 acres between 1930 and 1936 for every year but one. Farmers also began to devote an increasing share of their attention to grass seed. With the coming of better prices for overseas exports wheat production has declined, but the interest in grass seed has remained.

[*S. P. Andrew Ltd. photo.*

W. W. Mulholland, who during the 1920's was a spokesman for the Canterbury wheat growers and who later was president of the New Zealand Farmers' Union for several years.

The last 10 years, with steadily rising prices and assured markets, have brought many benefits to the Canterbury farmer. In recent years he has produced annually about 50,000 tons of meat and more than 150,000 bales of wool. The sheep population is 5,501,000, including 3,750,000 breeding ewes. Most important of all, the productivity of the plains is rising.

MANAGEMENT TRENDS

When war broke out in 1914 Canterbury farmers "had built up a system of mixed farming that was not only a source of pride and profit to themselves but a useful example to other provinces whose initial advantages in the way of open country were not so great". The impact of war did not radically disturb this system, even though it was subjected to many strains and stresses.

The systems of farm management in general use in Canterbury in 1925 were briefly discussed by Hilgendorf. Describing the shingle plains, he said:—

> On the better-class land the plough is constantly at work. The pasture consists of ryegrass with a little cocksfoot. Red clover shows in the first year or two and white clover appears spontaneously in good seasons. By the third year the pastures become very thin and consist chiefly of bare ground and hair grass with scattered tufts of cocksfoot. The land is then ploughed and put into a crop of soft turnips for winter feed or rape for summer feed for lambs. After the turnips rape may be taken or a crop of oats to be cut into chaff may be secured. New grass will be sown down either alone in the autumn or with the oat or rape crop.

On the better-class wheat land the practice was for the proportion of cocksfoot to be increased and dogstail added if some permanence of pasture was wanted. Hilgendorf said:—

> In from 3 to 6 years the grass has run out and so the land is ploughed for a crop of rape, potatoes, mangolds, or soft turnips. After the roots a crop of wheat is taken and then a crop of oats or barley, with which grass is frequently sown to start the pasture off on another rotation.

Grassland Deficiencies

The deficiencies in Canterbury's grasslands had caused some concern for many years, for in 1910 an observer declared: "It will perhaps not be far out to say that after the third year pasture ceases to be profitable".

This was also emphasised a few years later in 1920 by an Instructor in Agriculture at Christchurch, who wrote:—

> The condition of pastures generally is capable of great improvement. Large areas, quite 75 per cent. of the land returned as in English grasses, are completely run out, this applying equally to Canterbury and North Otago. Statistics show that for quite 20 years in neither of these has the stock-carrying capacity increased, although during that period . . . large properties have been cut up and considerable land settlement effected.

New ideas in pasture management spread slowly, partly because the tradition of arable farming was so firmly ingrained and by itself had achieved such notable results. The Canterbury climate, too, prevented the spectacular results that were being obtained in the North Island from being repeated. Up to 1930 pastures in Canterbury were sown down with a cereal or rape or turnips, the aim being that paddocks were in grass only to give them a spell, with cropping playing the dominant part in the farm management patterns.

Real changes in Canterbury farming probably began with the first contract sowings of Hawkes Bay ryegrass in 1929-30. Results were not always successful, as there was insufficient realisation of the importance of clover and the need for topdressing, but gradually the new, improved strains of ryegrass came into general use.

Decline in Cropping

Improvements in pastures, greater use of topdressing, and some decline in the area devoted to crops have been the main features of Canterbury farming over the past 20 years. About 1925 the average area devoted to crops was about 750,000 acres; the average for the 3 years up to 1945 was about 500,000 acres.

In the 1920's about 300,000 acres were planted each year in rape, turnips, mangolds, and chou moellier; more recently the area planted in these crops has dropped to about 220,000 acres, despite a rise in stock numbers and in the proportion of breeding ewes being carried. Though the area devoted to these crops has declined, they are still of vital importance to the arable farmer, and it is probable that they will play a significant role for many years.

The replacement of inferior pasture strains by better ones has given a much greater stability to the seed industry. During recent years the area devoted to grass seed has been about 70,000 acres. If the weather has been seasonable and the farmer has sufficient feed, he can afford to shut off a greater area for grass seed; moreover, he is influenced somewhat by the ruling prices. About 70 to 80 per cent. of the area set aside for seeds is entered for certification, and today most pastures are sown down with Certified seed or seed closely related to it.

Wheat

Between 1920 and 1931 the downward trend in wheat yields during the previous decade was reversed. Several factors were responsible for this, including the distribution of superior lines, the more effective control of smut and bunt, and the greater use of superphosphate. Between 1931 and 1935 the advance was not maintained, as wheat growing spread to inferior land and farmers tended to economise with seed, fertiliser, and cultivation. Since 1935 the trend has been upward once again, as wheat growing has been concentrated in the better-class land and the fertility of the soil has been improved by liberal applications of lime and superphosphate, together with the use of fertility-holding pastures.

Tractors have enabled the land to be cultivated more thoroughly, the header harvester has allowed farmers to economise in the use of labour, and over the last 10 years Cross 7 wheat has been found generally the most suitable for New Zealand conditions.

Subterranean Clover

The existence of subterranean clover in Canterbury was first noted early this century, and during the 1920's odd paddocks were sown with good results, but no real interest developed until 1935-36. Only over the last 15 years has subterranean clover exerted any appreciable influence on Canterbury farming.

In 1929 Messrs. Neave and Hewlett, of Christchurch, began a programme in which they sowed a total of 1000 acres of subterranean clover during the next 6 years. They found it was of great value on their light land at Ellesmere. Their account of their experience at the Grassland Association's conference in Christchurch in 1935 did much to stimulate interest and in 1936 sowings in Canterbury were both numerous and widespread and in 1937 they were even greater.

In these 2 years the clover was used rather indiscriminately, being regarded by many as a new "cure-all". It found its way into all types of land and was sown in every conceivable manner. Many mistakes were made and through no fault of the clover many farmers decided that it was unsuited to their conditions.

An intensive survey carried out by the Department of Agriculture in 1937 did much to uncover errors which had been made, and publication of the results led to the adoption of a steadier and more satisfactory sowing programme. Though its main field was on the light, stony land, it gradually came to be sown more and more on medium-class soils, where, associated with white and red clovers, it provided increased winter and early-spring growth.

On light land the use of subterranean clover has brought about marked changes, for it has extended the life of pastures which previously were not of much value after 3 years. It has also assisted lamb fattening in light land, and this in turn has led to an increase in the number of coarser-woolled sheep at the expense of the fine-woolled types.

The Lincoln College farm at Ashley Dene has shown the extent productivity can be raised by the judicious use of subterranean clover. At present most of the seed used is imported from Australia and the balance is produced in Marlborough. Production in Canterbury of subterranean clover seed has never been important.

The full effects of the widespread use of subterranean clover have yet to be felt, for one of its outstanding features is its ability to improve fertility.

Development of Sheep Industry

Sheep management has not changed very much over the past 20 years, and though the numbers of sheep have increased, the rise has not been proportionately as great as in some other parts of New Zealand. The potentialities of the plains are very great, but the risk of dry weather in summer and autumn has up to very recently hindered their full use.

At the beginning of the century English and Border Leicesters and Shropshires were used on the plains and Merinos and half-breds on the hills. With the growing emphasis on meat exports over the past 50 years a smaller, better-quality lamb was needed and therefore there was a gradual change-over to a Southdown sire. The influx of bigger sheep speeded up the change-over.

In 1949, apart from the hill country where the ewes are bred (half-bred 14 per cent., Corriedale 12 per cent., and on the high country Merino 16 per cent.), the Southdown was the dominant breed sire, 46 per cent. of all rams being Southdowns. If allowance is made for the rams used in the breeding country (on the hills), just over 90 per cent. of the fat lambs of Canterbury are today sired by a Southdown ram.

The Corriedale is Canterbury's own contribution to the history of sheep breeding, and today this breed is as well known in parts of South America as it is in New Zealand.

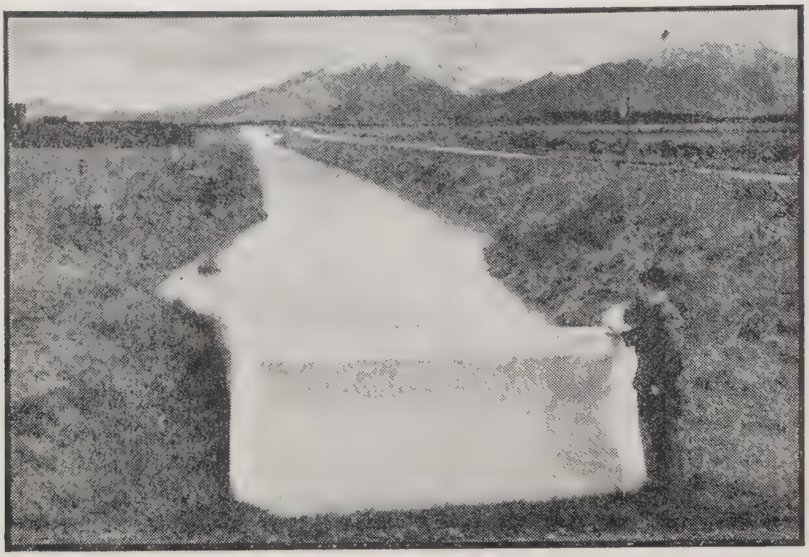
Much of the credit must go to James Little, who first began experimenting in North Otago with a Romney-Merino cross. Later he moved to North Canterbury and from 1878 he began using a Lincoln-Merino cross, and after years of painstaking work evolved a satisfactory type.

The Lincoln-Merino cross was perhaps most commonly used, but other long-woolled breeds were used; one of the most successful breeders, C. H. Ensor, used an English Leicester-Merino cross. It will probably be some time before there is quite as much uniformity of type in the Corriedale as in other breeds. At present a flock that has been continuously inbred for 15 years can be registered as a Corriedale flock.

[*V. C. Browne photo.*

Typical downland of North Canterbury. Land such as this produces fat lambs, store sheep, and arable crops.

FARMING IN CANTERBURY



[*Ministry of Works photo.*

The productivity of much of the land in Mid-Canterbury has been raised by irrigation. The Rangitata scheme, part of which is shown above, has brought water to nearly 100,000 acres.

Lime and Fertilisers

A deficiency of lime is characteristic of much Canterbury land, but the great economic importance of lime has been recognised only in the last 20 years. Experiments have shown that Canterbury soils give a good response to lime, particularly when it is combined with superphosphate, but farmers were at first somewhat slow in making use of it. When they realised its value they took it up with enthusiasm, for the consumption of lime jumped from an estimated 5000 tons in 1928 to about 300,000 tons in 1949, about a quarter of all the lime used for agricultural purposes in New Zealand.

Numerous workable deposits have facilitated its use, but despite the convenient sites of these deposits, the demand exceeds the supply. At present about 25 quarries are supplying agricultural lime and none of them was in existence before 1935. Lime spreading by contractors is now highly developed in Canterbury.

Topdressing with artificial fertilisers is not as important in Canterbury as in parts of the North Island. With very few exceptions, phosphatic fertilisers are used and topdressing trials have shown clearly that phosphates give reliable results only when applied on limed soils or on the heavier and better land. The disappointing results that have been secured in the past were caused by the fact that the pastures topdressed were made up of browntop and other low-producing species as well as inferior strains of ryegrass and clover.

In recent years better results were obtained with high-producing species and even more recently with subterranean clover. Progress in topdressing has run parallel with the growing appreciation of better strains and the importance of clovers as suppliers of nitrogen. The growing importance of grass-seed production to many Canterbury farmers has also brought about a greater use of fertilisers.

Cereal crops and supplementary green crops are nearly always sown down with superphosphate or reverted superphosphate. Topdressing in Canterbury has to a great extent been limited by the drier climate and until irrigation and the use of subterranean clover are extended topdresssing will not be able to assume the importance it has in some North Island districts.

The manufacture of fertilisers in Canterbury was first mentioned in 1883, when the "County Journal" referred to a trial of "Mr. Moorhouse's superphosphate" not long before Ivey imported the first superphosphate from England for trials at Lincoln. Even before this, bone meal from the boiling-down works was probably used, though information on any results is scanty.

The Christchurch Frozen Meat Company's works at Islington began in 1889 to produce large quantities of dried blood and other manures, and was the first meat works to pay much attention to this aspect of the work. It was not until 1922 that the fertiliser works at Hornby began production.

Irrigation

In Canterbury for part of the year the soil moisture is insufficient to supply a plant's requirements. The dry periods are mainly confined to January, February, and March. Stock-carrying capacity is thus limited to what can be taken through the dry months.

The need for irrigation to overcome these problems has been recognised for a long time, but there has been a great deal of controversy about the methods that should be used and whether any scheme would be both feasible and economic.

Water races were constructed in Ashburton County from the 1870's, but they were intended mainly to provide water for stock, with irrigation as a secondary consideration. Further work was done by the Ashburton County Council in the 1880's and some larger schemes were suggested by the council's engineer, but interest languished and was not revived until some experimental work was begun in the early 1930's by the Department of Lands and Survey and Lincoln College.

Late in 1933 the Ashburton County Council met other local bodies and representatives of Government Departments to investigate the whole question of irrigation on the plains. A large-scale scheme for irrigation and for the production of electric power was worked out, the technical details being evolved by officers of the Ministry of Works. Though the war interrupted the progress of the work, the 42-mile-long Rangitata diversion channel now brings water not only to irrigate nearly 100,000 acres of the plains, but to generate electricity at Highbank power station.

Just before the war two smaller schemes were brought into operation. The Redcliff scheme uses water from the Waitaki to irrigate about 5000 acres and the Levels scheme, using water from the Opihi, covers 13,000 acres.

Much has yet to be learnt about the technique of irrigation in Canterbury, and the aim in establishing the Department of Agriculture's research station at Winchmore was to gather data on this subject.

CROP AND PASTURE RESEARCH

The name of Professor Hilgendorf will always be associated with the improvement of crops by selection and seed certification. In 1910 the Director of Lincoln College suggested that an attempt be made to improve the Canterbury wheat varieties by a method of pure-line selection. Later

[*Green and Hahn Ltd. photo.*

F. W. Hilgendorf, whose pioneer work on seed selection more than 40 years ago led to the establishment of seed certification in New Zealand.

the work was expanded and by the end of the First World War considerable progress had been made in raising improved selections of the main varieties. In 1915 a selected line of Hunters was distributed, selected lines of Solid Straw Tuscan, Purple Straw Tuscan, and Pearl were distributed in 1918, and in 1920 a selection of the Velvet variety was released.

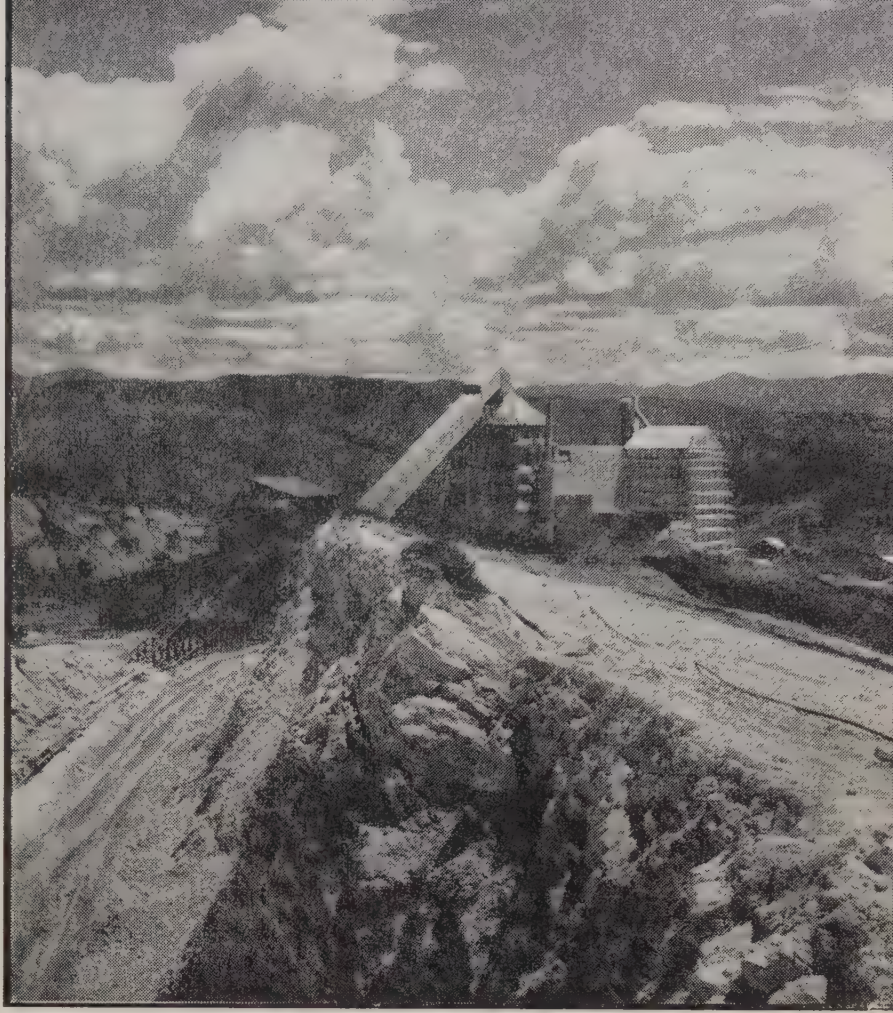
Within a few years of these releases it was estimated that most of the crops of Hunters, Solid Straw Tuscan, and Velvet grown in New Zealand were of the Lincoln College strain. Purple Straw Tuscan went out of cultivation in favour of the Solid Straw type, and Pearl was replaced by Velvet because of the better wind resistance of the last named.

Hilgendorf understood that the full value of his efforts in wheat improvement could not be obtained unless there was some method of identifying these wheats when they passed beyond the direct control of the college.

From 1919 to 1925 he made strenuous efforts to inaugurate some scheme of identification, but without success. His first plan involved the inspection of crops by himself with the assistance of students from the college; later he enlisted the assistance of field officers of the Department of Agriculture, but both efforts failed. In retrospect Hilgendorf's failures appear to have been caused either by lack of the co-ordination which exists today between farmer and seed merchant or by lack of recognition of the necessity for using to the full the available services.

Thus though he planned that farmers with approved crops should sell their produce direct to other farmers desiring selected seed, the former group preferred to sell their grain as one line to their merchants rather than to sell in small lots direct to other farmers. The merchants in turn were not interested in reserving this grain for seed purposes, as so many farmers saved their own seed requirements each year.

R. A. Calder, who as an Instructor in Agriculture in South Canterbury and later as Director of the Agronomy Division of the Department of Scientific and Industrial Research was closely associated with scientific advances in Canterbury farming over the past 25 years.



[*National Publicity Studios photo.*

Lime production in Canterbury, where there are about 25 quarries, increased from about 5000 tons in 1928 to about 300,000 tons in 1949.

It was in the mid-1920's that considerable expansion took place in the activities in Canterbury of the Fields (now Extension) Division of the Department of Agriculture. J. W. Hadfield, who was appointed to the Department in Christchurch in 1926, interested himself in raising reselected lines of wheat at an experimental farm at Ashburton, but, more important, he formulated plans for the establishment of a scheme of certification of seed wheat which depended for its success on the co-operation of the farmer, the merchant, Lincoln College, and the Department of Agriculture.

Wheat Research Institute

In the meantime Hilgendorf had initiated a programme of cross-breeding of wheat at the college. In 1928 the Wheat Research Institute was established, with Hilgendorf as Director, which linked into one organisation the combined interest of wheat growers, millers, bakers, and merchants, the college, and the Departments of Agriculture and Scientific and Industrial Research.

The institute took over the plant-breeding work which Hilgendorf had begun at the college, and Hadfield developed his organisation of a Pure Seed Station (later to become the Agronomy Division of the Department of Scientific and Industrial Research), which was to provide an annual supply of reselected seed of recognised varieties for multiplication and distribution under the certification scheme. This organisation with only minor changes has planned and guided and developed many of the improvements in wheat growing which have been adopted in the last quarter century.

First there was a new variety, Cross 7, a wheat cross made by Hilgendorf himself but taken over by the Wheat Research Institute and released for commercial growing in 1935. In the following years there was a great increase in the acreage devoted to this variety and for a number of years it has represented more than 75 per cent. of the total New Zealand wheat acreage.

Tainui, a reselection of an imported variety, followed and found a place as a spring-sown wheat in the North Island. Fife Tuscan, another crossbred variety, has now almost entirely replaced Solid Straw Tuscan on the lighter Canterbury lands, the only soils left to this latter variety after the introduction of Cross 7. Latest releases are Hilgendorf and W.R.I. Yielder, two varieties which have yet to prove their real worth in commerce

Fife Tuscan wheat near Methven just before coming into ear. Since 1935 the trend in wheat yields in Canterbury has been upward.

but which have their own particular claims to merit.

The control of disease during this period had not been overlooked, and the practical application of the hot-water treatment to control loose smut, together with the use of organic mercurial dusts to eliminate covered smut, have reduced losses from these causes to the minimum.

Though the college has given attention to the oat crop, releasing a selection of Algerian oats in 1923 and selections of two other varieties in 1925, this work has not met with the spectacular success associated with wheat. Nevertheless, the oat crop is now receiving consideration along very similar lines and Certified seed of the main varieties is available. In addition, an oat-breeding programme has produced several types, at present under extensive trial.

As a natural corollary to the work in wheat and oats the Agronomy Division (now renamed the Crop Research Division) of the Department of Scientific and Industrial Research at Lincoln interests itself in breeding and selection work with barley, peas, linseed, linen flax, and other crops. Results so far have not been as outstanding as those obtained with wheat, but satisfactory progress has been made.

Pasture-plant Improvement

Preliminary work on the improvement of pasture plants was begun at the college in 1924 with ryegrass and cocksfoot and 3 years later with red clover. Reorganisation of scientific efforts, however, led to the concentration of pasture-plant improvement at Palmerston North and only the college selection of cocksfoot survived to fill a place in commerce. This cocksfoot (C.23) is the recognised pedigree strain in the certification scheme of the Department of Agriculture today.

In another way Canterbury has played a big part in the development of pedigree strains of pasture plants. By identification of superior strains (first natural strains and later pedigree strains) under the seed-certification scheme it was found possible to capitalise on the undoubted advantage of Canterbury as a seed-growing area and at the same time to minimise the factors which had led to strain deterioration in the past.

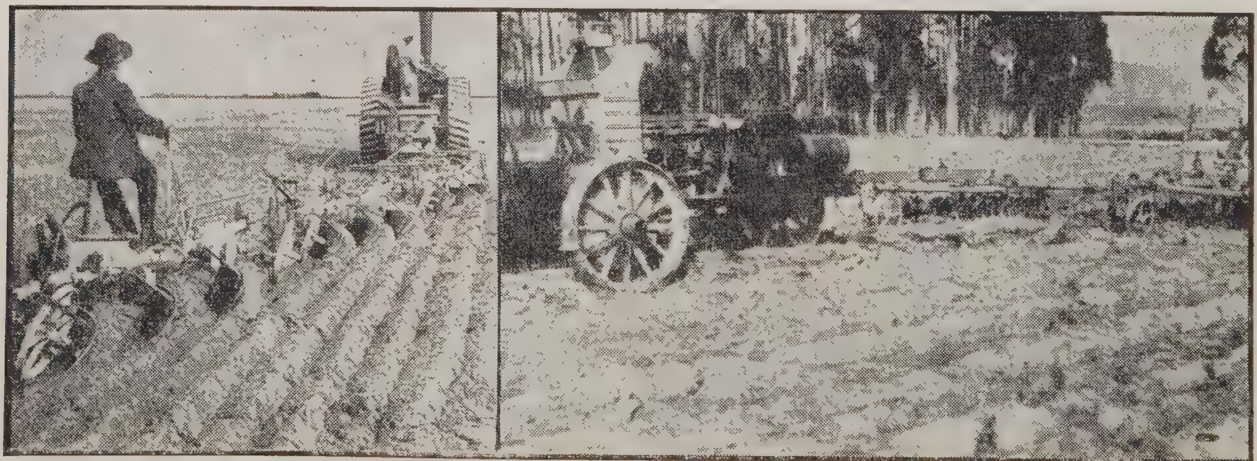
FARM MACHINERY

The period from 1880 to 1915 is essentially one of improvement in the design of farm machinery and that from 1915 to 1950 is one in which the power of the internal-combustion engine has been applied to the needs of agriculture. In New Zealand, with the gradual subdivision of the land from 1890, the demand for cheap, serviceable, and efficient implements rose considerably and local foundries expanded their production to meet these needs.

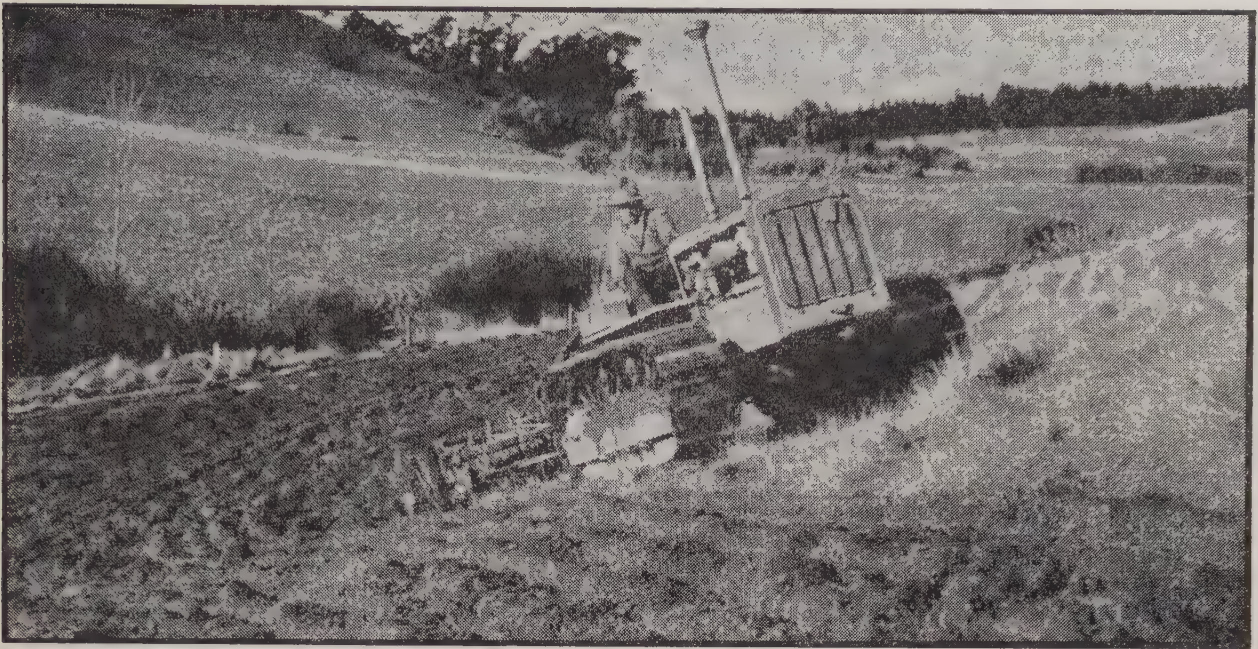
By 1880 a satisfactory plough for New Zealand conditions was already being produced. Over the next 40 years no basic changes were made in the plough, apart from the 3-furrow riding type which appeared about 1900, and this was only an adaptation of the earlier model. Digger, mole, and swamp ploughs were also produced as the need for them arose.

The twine binder, fitted with an Appleby knotter, was imported into Canterbury in 1880; some models from various overseas firms were being used and in essentials did not change for many years; even the coming into use of the power binder, the first model of which was displayed in Christchurch in 1925, did not radically change the design.

Unlike some other inventions, the header harvester had been used for many years in America and Australia before it was tried out in New Zealand in 1927, for New Zealand wheat growers were convinced that it would not suit local conditions. Power-driven hay balers appeared after the



Left—Before introduction of the tractor steam ploughing with traction engines was done on some of the larger properties in Canterbury. Right—This British-made Sanderson is believed to be one of the first tractors used in Canterbury and was imported about 1907.



[*Green and Hahn Ltd. photo.*

Track-laying tractors were slow in gaining popularity, but farmers gradually discovered their usefulness on the Canterbury downlands.

First World War, replacing the small hay presses that were in use earlier.

The most spectacular change in agriculture over the past 30 years has been the coming into widespread use of the tractor, but here again New Zealand has adopted what has been tested overseas and has not made any original contribution to design.

Formed in 1863, just as the "man-power" era of farming was going out, the Canterbury Agricultural and Pastoral Association has been closely linked since its foundation with the testing and application of farm machinery and provision was made at the association's first show for a display of farm implements. Another useful service of the association was the organisation of trials and competitions between different makers' products.

Development of the Plough

For many years the 3-furrow lever plough was the type most widely used, and an adaptation of this, the riding plough, was introduced about 1900. The various levers were altered so that they could be worked from the seat, and part of the draught at the drawbar was applied to the lifting lever so that the ploughman could raise the plough with ease.

When steam engines were used for ploughing, 2- and sometimes 3-furrow ploughs were hitched in tandem, with a man in attendance to raise and lower each plough at the turn on the headlands. With the introduction of the tractor it was realised that something better was needed. In 1925 P. and D. Duncan Ltd. in their catalogue announced the "Auto" lift for fitting to horse ploughs. With this device a pull on one cord lifted the plough and another pull on the same cord lowered it to re-enter the ground. Four-furrow tractor ploughs of medium weight, essentially horse ploughs with the "Auto" lift added, were priced at £83 10s., and heavyweight tractor swamp ploughs were selling for £19 15s. In the late 1920's special tractor ploughs were manufactured in New Zealand to meet competition from imported ploughs.

In 1939, with the arrival of the Ferguson tractor, a 2-furrow plough consisting essentially of beams, skeiths, mould-boards, and shares was produced—the plough that fitted the 3-points linkage of the new tractor. In post-war years, with the arrival of other makes of tractors incorporating this linkage, Reid and Gray, of Dunedin, began manufacture of this type of plough.

Special-purpose Ploughs

The hillside plough appeared in 1884, a copy of the Murray 1-way plough well known in England at the time. The swamp plough was evolved as an entity in 1901; this was the lever-pattern swamp plough, constructed primarily for bringing swamp land into cultivation. It could be used where no other plough could and was fitted with wide rims on the wheels to prevent its sinking in the soft soil. It could be worked on land where rushes were as high as the horses' backs, and with this plough 4 good horses could turn a furrow 24in. wide. It was equally well adapted for very stony land or for use among gorse roots. In later years when fitted with chains this plough made an excellent job of turning both rushes and scrub, leaving the ploughed land very clean.

Though digger ploughs had been used for a few years in Canterbury, it was not until after 1891 that they were widely known. A trial conducted by the Canterbury Agricultural and Pastoral Association in that year attracted entries from Reid and Gray, P. and D. Duncan, and James Reid, of Oamaru. All the ploughs worked satisfactorily, particularly the Howard digger, entered by James Reid. The points and shares were made of chilled steel, "a material that is now much used at Home and which enables the work to be done very smoothly, the metal becoming polished as a mirror when worked a little".

In 1893 the mole plough was put on the market. It was priced at about £15 and was for "boring drains any distance down to 24in. below the surface; a cheap and expeditious manner of draining large tracts of land". A traction engine or 8 to 12 good horses were required to pull it.

Water-race ploughs were manufactured in 1893 and when trailed behind a traction engine or 10 to 12 horses made races 2ft. 3in. to 3ft. 6in. at the bottom in one operation. They were especially suitable for county councils and contractors, weighing about 16cwt. and being priced at "about £40".

The most recent development has been the construction of pneumatic-tyred ploughs, one being built by Booth Macdonald in 1947. It was fitted with a ram and hoses worked by a hydraulic pump on the tractor. By shifting a lever a trailed plough could be raised or lowered at will. In 1950 P. and D. Duncan built their largest plough, a 5-furrow tractor plough mounted on rubber, for a contractor at Ashburton.

FARM MACHINERY IN CANTERBURY . . .

Binders

Soon after the first twine binder was imported into Canterbury a trial of three twine and three wire binders was conducted by the Canterbury Agricultural and Pastoral Association, and 2 years later, in 1882, a further trial attracted the entries of only three wire and nine twine binders. The work of all the binders was highly praised by the judges. In 1887 the "Buckeye" reaper and binder was first demonstrated and soon proved popular, for with its low centre of gravity it could negotiate slopes where others would capsize.

Over the next 30 years few changes were made until the first McCormick Deering power binder arrived in New Zealand in 1925. Other manufacturers quickly followed in adapting their machines to be powered by a tractor, but the binder has remained essentially similar to the machines used in the 1880's and 1890's. In recent years the binder has been used for windrowing of crops for threshing by the header.

Header Harvesters

Australian, Canadian, and American experience all helped to create the header harvester, a satisfactory machine of reasonable size being evolved by 1910.

It was not until 1927 that a "Sunshine" header was brought from Australia to harvest a large crop of peas on a farm at Doyleston. The same year an unassembled machine was brought to New Zealand, put together, and finally harvested 3½ acres of wheat at Wakanui under very difficult conditions, the first wheat to be header harvested in New Zealand. The machine proved to be satisfactory in every way.

Four different machines were displayed at the 1929 show of the Canterbury Agricultural and Pastoral Association, one of them, a McCormick Deering, having a pick-up attachment to enable crops to be threshed from the windrow. It was powered from the tractor, unlike the first "Sunshine" machines, which were driven from the ground wheel.

Smaller, lighter machines have been popular in the last 10 years, as they suit the farmer with limited areas in grain and are especially suitable for those growing small seeds.

In recent years the header harvester has enabled the wheat- and grass-seed industries to carry on at a time when shortages of labour might have disorganised them very greatly. The change-over to the header harvester has also been speeded up by the great increase in the proportion grown of Cross 7 wheat, an excellent heading variety. By 1948-49 there were 1227 headers in Canterbury, a remarkable increase in little more than 20 years.

Hay Balers

Though small, stationary hay presses were used in New Zealand before 1914, it was not until 1918 that the Case stationary hay press, a machine with sufficient power to stand up to New Zealand conditions of heavy cropping was introduced. The first pick-up baler was introduced in 1930, and developments over the next few years were intended to reduce the number of men required on the machine. A semi-automatic baler appeared in 1931, followed in 1941 by the "New Holland Automaton", which required only a man in the tractor and a boy to check the baler. Since the war newer, cheaper, and more efficient machines, which can be used on a medium-sized farm, have come on the market.

Tractors

One of the earliest tractors to be put to work in Canterbury was a 3-wheeled Sanderson, an English tractor, a few models of which were imported by a farmer at Leeston. It was powered with a 6in.-diameter piston with a 6in. stroke and was driven and steered through universal gears on the front wheels and through a roller chain to the back wheels. This tractor pulled either two sets of 9-aside disc harrows or two 3-furrow lever ploughs in tandem.

In 1911 the first two International Harvester Company tractors were sold; these were "Titans" and were followed soon after by "Moguls". The "Titan" had only one speed either forward or in reverse, 2½ m.p.h., and was too slow for most types of farm work.

Tractors were first exhibited at the 1913 show of the Canterbury Agricultural and Pastoral Association, when the Ivel agricultural motor was displayed. Exhibits became more numerous after that and the Fordson was first displayed in 1919.

In the mid-1920's track-laying tractors were first used, a "Cletrac" model taking part in ploughing matches in 1926 and 1927. At first the track-laying tractor did not seem to offer any advantages on the dry, level plains, but its value on heavy land was soon realised. The Allis Chalmers "Model W", one of which was sold to a Mid-Canterbury farmer at the end of 1935, was the first rubber-tyred machine in New Zealand fitted with a gear box for higher speeds.

Row-crop models, fitted with power lifts, were introduced just before the Second World War and about the same time the first Ferguson tractor, the one using hydraulic power through a 3-point linkage, was brought out. This revolutionised the mounting of standard farm implements, but it did not come into general use until after the war.

Since the war an increasing range of British tractors suitable for Canterbury conditions has appeared on the market and helped to alleviate the shortage of American machines.

Gorse Cutters

A machine that had some special interest for Canterbury farmers was the gorse cutter, the first being tried out in 1880 and a more efficient model the next year. P. and D. Duncan's machine, brought out in 1882 and improved in 1887, had blades that revolved at 300 r.p.m. when pulled by a horse at 3 m.p.h. In 1900 John Anderson mounted two gorse cutters on a traction engine, one knife for cutting the side and one for cutting the top. In 1925 a gorse cutter was mounted on a Hart-Parr tractor.

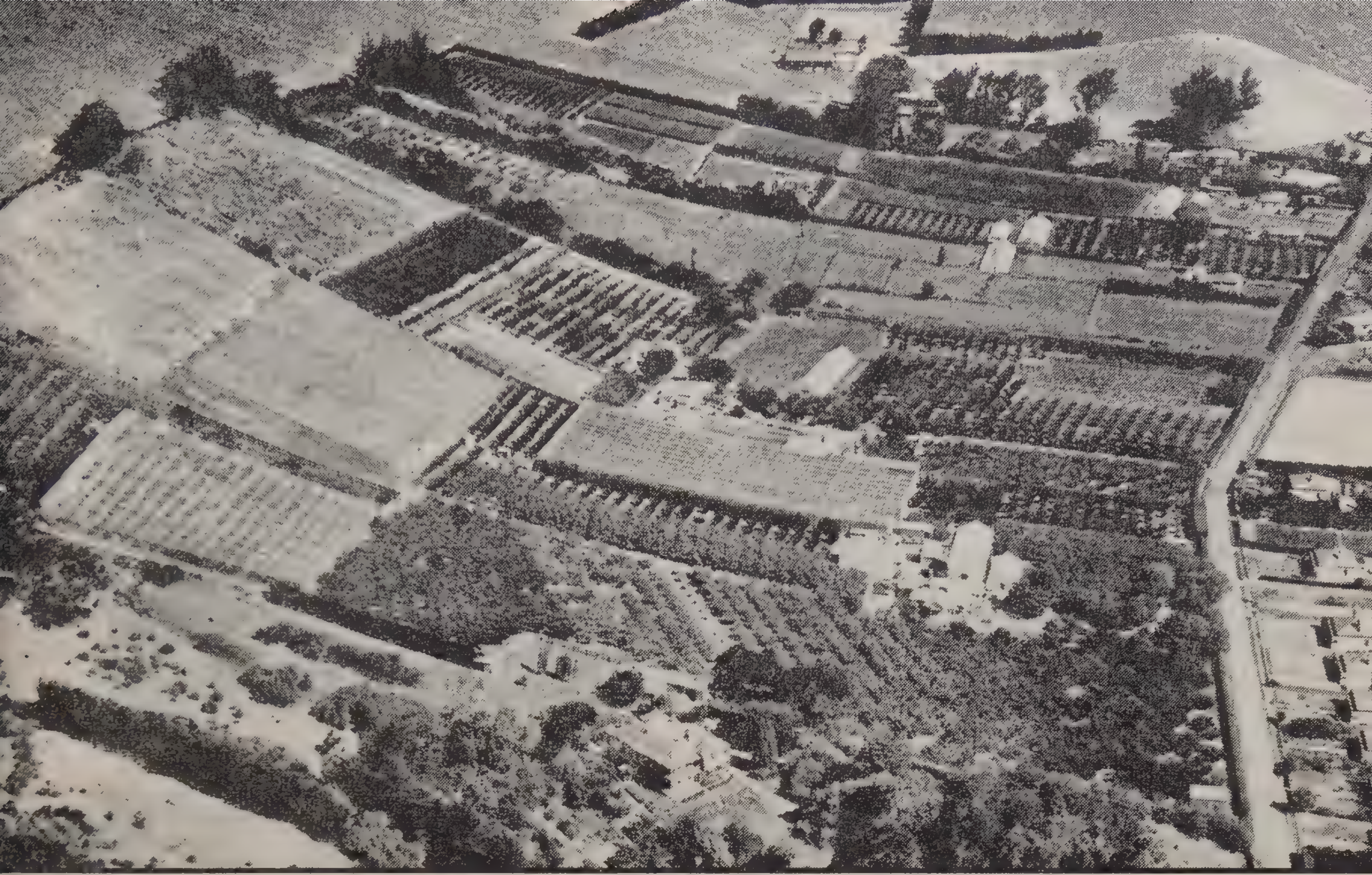
Drills

By 1890 P. and D. Duncan offered seven different patterns of grain drills, the force feed being first used about the same time. Drills fitted with disc coulters were announced in 1914, but they never proved popular and today are scarce. With the introduction of the tractor, Murray lifts were fitted to drills so that the coulters could be raised or lowered at will, and local manufacturers are now making drills fitted with pneumatic tyres.

Discs and rollers have altered little over the years, though very heavy rollers have been constructed in Canterbury to push stones into the ground.

[*Ministry of Works photo.*

Header harvesters have increased with the larger sowings of Cross 7 wheat, and small models have become popular in recent years.



[*V. C. Browne photo.*

Intensively cultivated small holdings are numerous around Christchurch. This aerial view shows part of Heathcote Valley, where fruit and vegetables are produced.

Over the past 60 to 70 years local manufacturers have played a significant part in constructing machines suitable for New Zealand conditions or successfully adapting overseas ideas. They have, too, been quick to bring to New Zealand any new machine that could not be produced locally. Some overseas inventions have been adopted by New Zealand farmers very soon after they have been first produced, and others have spread only gradually. Farmers have generally known what was the most efficient and the most economical and their purchases have been determined by these considerations.

It is interesting to note today the changes in the prices for the 2-furrow and 3-furrow ploughs over the years, these machines being those manufactured for the longest period.

In 1882 the 2-furrow lever plough was selling for £16 10s. and the 3-furrow model for £20 15s. By 1901 the first price had risen to £19 and the second to £26 10s. In 1920, the 2-furrow model was £34 15s. and the 3-furrow £49 5s. In 1939 the 2-furrow tractor plough was £83 and the 3-furrow £105. By 1950 they had risen to £103 and £124 respectively.

MINOR INDUSTRIES

Canterbury has always played an important part in supplying New Zealand's requirements of potatoes, onions, vegetables, and, to a less extent, fruit. Though the province produces about half of New Zealand's potatoes, the area planted in this crop has always fluctuated somewhat, but averages from 12,000 to 14,000 acres a year. The main areas have been around Christchurch and Waimate, with the Ashburton, Ellesmere, and Rangiora districts also important.

The value of certification has generally been realised over the past 10 years and up to 50 per cent. of the crop is now entered for certification.

Onions have been grown for many years in the Marshland district, where consistently high yields have been obtained. Vegetable growing, too, is important around Marshland, Harewood, Papanui, Burwood, and in the valleys running up into the Port Hills. The number of small holdings on the outskirts of Christchurch is very great and many of these are used partly for vegetable growing. Some have become highly specialised. Loburn, in North Canterbury, has been noted for its apples and pears, with Waimate equally noted for some of its small fruits.

The climate and the well-drained soil as well as the plentiful supplies of grain have been responsible for the success of poultry farming in Canterbury. Besides the great number of household flocks, many large-scale enterprises have been established, though in recent years the relative importance of Canterbury in egg production has declined. Commercial poultry keeping is also largely confined to the fringe of small holdings around Christchurch.

Significant Changes Today

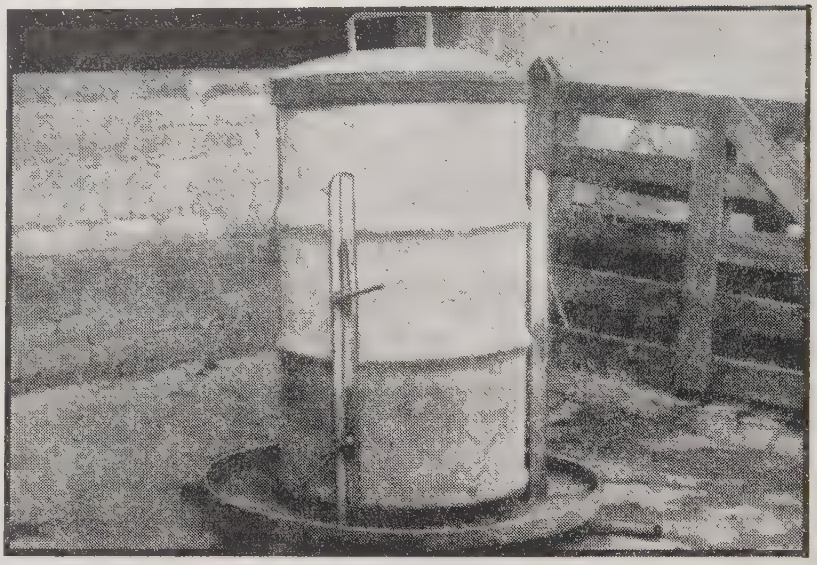
In the 1890's Canterbury farmers were able to evolve a system of mixed farming and crop rotation which in its time was a model for the whole country. Later a system of grassland farming was evolved in the North Island which enabled farmers to dispense very largely with the plough. As the system's success was due to the warmer and more humid climate of the North Island, it could not be taken over by Canterbury farmers without prolonged testing and modifications.

Now, with the deliberate use of better pasture strains, the greater application of lime and fertiliser and the development of irrigation Canterbury farmers are in the process of making changes almost as significant as those made over 50 years ago.

Essentially they depend on making greater use of and placing of more reliance on pasture. The full effect of these changes has yet to be felt, but they have already strengthened greatly the farmers' position. Though these changes may have reduced the emphasis on arable crops, the Canterbury farmer still has the opportunity to direct a greater share of his attention to arable farming.

Home-made Self-feeder for Pigs

WHERE large numbers of pigs are kept, and particularly where a considerable number of store pigs is wintered, anything that will reduce the labour of feeding them is of value. A simple and ingenious home-made self-feeder which was seen recently on a farm is described in this article by I. H. Owtram, Extension Officer in Pig Husbandry, Department of Agriculture, Wellington.



The self-feeder. The position of the bar across the bottom on which the feeder rocks is shown by the pieces of pipe on either side of the base.

THE self-feeder is easy to construct out of material that can usually be found lying about and saves a considerable amount of labour, particularly in feeding grain or meal. It is very simple and cannot get out of order. Almost every farm has a workshop and many farmers have a welding outfit; in that case the construction of the feeder is very simple.

The materials required are a 40-gallon drum, 3 pieces of angle iron about 2ft. 6in. long, an old cart tyre about 3 or 4ft. in diameter, a piece of steel plate large enough to cut to 3ft. diameter, six 4in. x ½in. bolts with nuts, and old pieces of ½ and ¾in. pipe.

Construction

The method of construction is as follows:—

A disc 3ft. in diameter is cut out of the steel plate and a piece of the old cart tyre is welded to the edge of this to form a rim 3 to 4in. high. This is the base of the feeder. The drum is then stood in the centre of the disc and a circle is marked round its edge. Two slots 6in. by ½in. wide are cut in one side of each piece of angle iron 6in. apart and 6in. from either end. At three equidistant points on the circle on the steel disc the pieces of angle iron are welded on to the base vertical to it.

Both ends of the drum are cut out, one end being cut so that the rim of the drum is still attached to the end that is cut out. Another piece of the cart tyre is welded round the edge of this and a handle made from an old smoothing iron is welded on to the centre. This forms the lid of the feeder, which must, of course, be weather proof. The other end of the drum is cut out so that the inside is left quite smooth.

The drum is placed on the base between the 3 angle-iron uprights and marks are made on the drum at the lower end of the slots in the uprights. At these points ½in. holes are drilled. The drum is then again placed between the uprights and the bolts are inserted through the holes in the drum and the slots in the uprights. The heads of the bolts are secured inside the drum by welding.

Washers of sufficient length to keep the nuts on the bolts clear of the angle iron are cut from ½in. pipe and a short piece of ⅜in. round iron is welded to each nut to form a handle for screwing it up.

Finally a piece of ¾in. piping 3ft. long is welded across the bottom of the base. This causes one edge of the base to be an inch or so off the ground. This is shown in the illustration, but to make this point clearer the pipe was extended beyond the base.

Method of Operation

Feed is placed in the drum, which is raised a sufficient distance from the base to allow the feed to run out at the desired rate. This distance varies with the food used and is adjusted by the nuts and bolts in the slots on the angle iron.

Pigs put their feet on the base and, because of the pipe across the bottom, impart a rocking action to the whole feeder and so shake the feed down into the base. The feeder should stand on a concrete platform or a hard, level piece of ground.

The feeder can be used for maize, barley, wheat, peas or any meal, and even roots that have been put through a turnip slicer or waste from food factories can be used in it. The height that the drum must be above the base for each particular feed varies and can be found easily after experiment.

This feeder is efficient and cannot be overturned by the pigs, owing to its wide base. It reduces the number of times that the pigs have to be fed and eliminates much waste. As soon as the pigs are used to it they come up a few at a time and after a small feed go away, so that the usual fighting and pushing at the trough are avoided and pigs do not gorge themselves.

Where a large number of pigs is being wintered this feeder will amply repay its small initial cost.

SEED SUPPLIES OF NEW CEREALS

THE Department of Agriculture has grown under contract this season several new varieties of cereals and expects to have available for distribution certified seed of the following:—

Wheat

W.R.I. Yielder: This new variety was described in an article in the March, 1948, issue of the "Journal." Certified Mother and Certified Standard seed will be available.

Ryecorn

N.I.A.B.: This is a selection made by the National Institute of Agricultural Botany and in trials it has shown promise as a greenfeed. Ryecorns usually are hardier than oats and barley and this selection produces well and makes good recovery after grazing. Certified Mother seed will be available.

Barley

Wong: Wong is a greenfeed type of barley introduced from China. Its growth is more dense than that of other varieties and it shows strong powers of recovery after grazing. Seed of the Certified Mother and Certified Standard classes will be available.

Further Trial of Varieties

The Department considers that these new varieties are worth further trial on a commercial scale, and seed supplies are being released accordingly. Areas sown with Certified Mother seed will be eligible for re-entry into certification, but areas sown with Certified Standard seed will not.

[*Sparrow Industrial Pictures Ltd. photo.*

The Home Garden in March

By H. P. THOMAS, Vegetable Instructor, Department of Agriculture, Wanganui.

ALTHOUGH sowings and plantings of vegetables are confined to relatively few varieties during March, it must not be thought that the garden can then look after itself until spring activities demand attention. This month and the next one or two are important months to begin fortifying the ground as it becomes vacant in preparation for another full year's vegetable production.

AT present many crops will be maturing and home gardeners should be reaping some benefits from their labours. If successional sowings have been carried out, the following are likely to be available now: Tomatoes, green vegetables, root vegetables, salad crops, peas, beans, and cucurbits. After harvesting, the residue from the crops provides excellent material for immediate digging in or preferably for the compost heap. Earlier-sown crops such as spinach, lettuce, and silver beet may need thinning. If more of these crops are required, some of the plants removed can be transplanted. It is best to do this work on a dull or showery day.

Watering or liquid manuring of growing plants should be attended to whenever necessary. A good supply of water should be maintained for vegetables, as owing to their quick growth they require more than many flower plants. If vegetables are grown quickly, they are tender and of better quality. As weeds rob the ground of moisture, the hoe should be kept going during fine weather; thorough hoeing should always follow watering or rain as soon as the surface is sufficiently dry to work. The harvesting of onions and shallots, if not completed, should be proceeded with as soon as possible.

In northern districts where tomatoes and potatoes continue to make growth spraying is still advisable and attention in this respect is necessary for brassicas and celery also. For the prevention of fungous diseases apply Bordeaux mixture (4oz. of copper sulphate, 5oz. of hydrated lime or burnt lime to 4 gallons of water) or a similar suitable copper fungicide.

For the control of insect pests arsenate of lead can be added to the Bordeaux mixture at the rate of 2oz. to 4 gallons of spray. If preferred, D.D.T. 50 per cent. wettable powder at ½oz. in 4 gallons of water may be used instead of arsenate of lead.

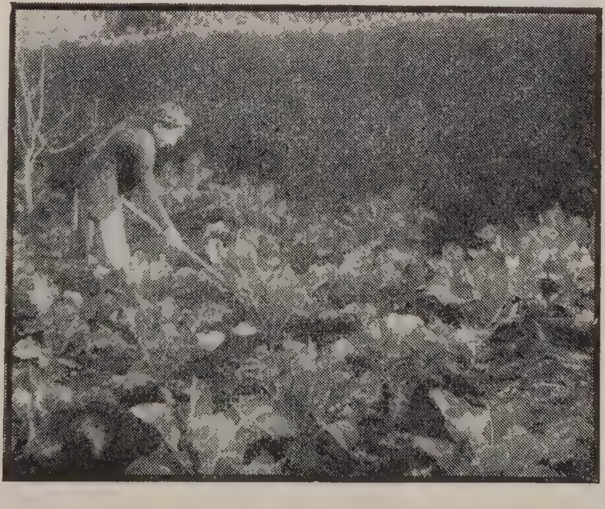
Building up Soil Fertility

The next few months can be considered as a "spring-cleaning" period in the home garden and for continued success the home gardener must give thought and effort to building up soil fertility again.

A cardinal law of nature which unfortunately is often ignored is that what has been taken from the soil must be returned to it. If plants continually grew, died, and decayed, as they do if left to themselves, then with the aid of bacteria, fungi, earthworms, and other organisms the decomposing organic matter would gradually increase fertility.

However, in home gardens this is not the case, most of the plants being removed for consumption. Every crop leaves the ground poorer because the plants have absorbed considerable quantities of plant food during their growth.

The organic matter must first be built up again, and as animal manures in quantity are difficult to obtain, this may be done by green cropping and by converting all waste material from house or garden into humus. If composting cannot be carried out, the alternative is to incorporate waste material directly into the soil as vacant plots are being dug over.



[*Sparrow Industrial Pictures Ltd. photo.*

Every advantage should be taken of fine weather to cultivate between growing crops.

THE HOME GARDEN IN MARCH

[*Photo News Ltd. photo.*

A cover crop of oats, peas, and lupins sown following potatoes. Vacant ground should be sown in some cover crop rather than be left idle.

Types of Soil

It is realised that there is more choice for site and size of area for the vegetable garden in the country than in towns, where areas are fairly small in many cases, and town gardeners must make the best of the site and soil available.

Less favourable soils can be improved, however, and a small garden well cultivated and cropped to provide a succession of vegetables will give better results and more satisfaction than a large one indifferently managed. If the soil is clayey and inclined to be heavy and stiff, it may be necessary to lay drains. In preparing a garden attention to drainage and shelter is a first consideration. Do not cultivate or dig a heavy type of soil while it is wet.

Digging or trenching should be done in autumn or early winter, as conditions are suitable then and digging at this time allows the beneficial weathering agents to act on the cultivated ground throughout the following months. No matter what the nature of the soil it is very important to dig over the site to at least two depths of the spade. The second spit should be well broken up with the spade or fork, but it should not be brought to the surface unless it is of a similar nature to that of the topsoil. Materials such as long strawy manure, compost, wood ash, sawdust, or coarse sand can be incorporated if the subsoil is a heavy clay; they not only supply some necessary plant foods, but improve the physical condition of soils. A dressing of burnt or hydrated lime at 4oz. to the square yard is also valuable for heavy soils. If properly handled, a heavy soil is usually fertile and very retentive of plant foods and that essential, humus.

Light sandy soils, too, need organic material; it binds them and makes them more retentive of moisture. Such conditions assist in the conservation of plant food which may otherwise be lost through leaching. Materials such as farmyard manures, leaf mould, compost, and even clay soil can also be incorporated to improve the texture and fertility of light soils. Green manure crops such as lupins, oats, and mustard also play a large part in conjunction with the soil-improving methods already mentioned, especially if other organic materials are in short supply. Even with land between the extremes it is necessary to keep the soil well supplied with humus by any or several of the methods mentioned. Replenishment of organic material in the soil not only supplies some necessary plant foods, but stimulates biochemical activity and gives the soil a spongy character, which is important, as plants absorb food from the soil in liquid form.

Fertilisers

Though organic material which eventually forms humus is very important both as plant food supply and for its physical action on the soil, mineral and organic fertilisers will supply readily-available nutrients. The use of fertilisers in the home garden requires a knowledge of the respective functions of their phosphatic, nitrogenous, or potassic constituents and of how to apply them, or a great amount of harm can be done to crops. To get the desired results from a particular crop it is necessary to see that as far as possible the correct fertiliser is applied.

For instance, it is helpful for the home gardener to know that nitrogen promotes leaf growth and therefore is of particular importance to vegetables which are grown for their succulent leaves (lettuce, cabbage, silver beet, etc.). Phosphate (phosphoric acid) assists root formation and early ripening and is therefore of particular importance to crops grown for their seed or fruit (peas, beans, tomatoes, etc.). Potash strengthens plants, promotes quality in fruit, and makes plants more resistant to disease; it is also valuable for root and fruit crops (carrot, parsnip, turnip, potato, etc.). As ideal plant development is rarely possible where applications of only one or two of the three main plant foods are made, complete or balanced mixtures, which contain the three main essentials, are commonly used. It must be stressed that an excess of any of the plant foods mentioned cannot make good the deficiency of another.

Green manuring to improve humus content and regular use of a complete fertiliser will result in tender produce of good colour and flavour and rich in vitamins.

Small Plantings

Though few subjects can be sown now in most districts with prospects of their maturing before winter, small plantings of some of the early-maturing kinds can be made in favourable localities or situations. The use of raised beds is of assistance where high rainfall is usually experienced, and sheltered borders facing north can be utilised from this time onward as well as in spring.

Plants such as spring cabbage and cauliflower, if they become established, will hold during winter and mature early in spring.

Celery

Although most gardeners are likely to have celery crops well advanced by now, it is possible to make a late sowing in March in districts where autumn and early-winter conditions are fairly mild.

Established crops will require a liberal and regular supply of moisture. If growth is slow, side dressings of a nitrogenous fertiliser such as sulphate of ammonia or nitrate of soda should be applied as a liquid manure (1oz. to 4 gallons of water).

Weeds must be kept in check or the crop will suffer. Plants of early varieties put out in the new year will be making substantial growth and attention will soon have to be given to blanching if they are not of the self-blanching type. Artificial blanching of celery is preferred, particularly when celery is to be eaten raw. Many methods of blanching are used, but trenching and earthing up or banking with soil are not done to the same extent as in the past, though it is often claimed by some gardeners that the quality of the celery blanched in this way is superior. As rots often develop in soil-blanched celery in hot weather, earthing up is more satisfactory in colder districts or for autumn planting.

Blanching may be done by placing 10in. x 12in. x 1in. boards on both sides of the plants if they are grown in single rows. These boards are held on edge by pegs driven in on either side. When celery is grown in a bed of two or more rows boards placed round the bed and close to the outside rows are sufficient to blanch all the plants.

Another method is to wrap plants with good-quality paper to a height of 12in. to 15in. from the ground. If this method is adopted, the paper

[*Green and Hahn Ltd. photo.*

The board along this row of celery was removed to show the blanching achieved.

should not be wrapped from ground level; a space of several inches should be left to allow for air circulation. In taller varieties it is sometimes advisable to tie the outside leaves loosely near the top, especially in districts where strong winds are experienced at the time plants are reaching maturity.

Varieties

The self-blanching types are earlier and grow well under favourable conditions, although the late, hardy winter varieties adapt themselves best to cold weather, which can be expected soon. Gilt-edged Golden (early self-blanching), and Solid White (late) may be planted this month according to local conditions.

Cauliflower

A further sowing of cauliflower seed may be made this month for the production of plants to set out in April for August-September harvesting. Except in mild climates it may be advisable at this time of year to raise the young plants under glass or in very sheltered situations. If cauliflowers are severely checked after being planted out, poor results are likely.

The soil or seed-bed should be of a fine tilth and well drained. At this time of the year it is wise to spray the young seedlings with Bordeaux mixture at 10- to 14-day intervals as a precaution against mildew to which they are very susceptible, especially in the seed-bed.

Plants which were raised from seed sown early last month may now be ready for transplanting. The soil should be rich in well-rotted organic manure, supplemented by a complete fertiliser applied at the rate of 4oz. per square yard and thoroughly incorporated during cultivation. For most soils a mixture of 3 parts of blood and bone, 1 part of superphosphate, and ¼ part of sulphate or muriate of potash, all by weight, is suitable.

Liming is necessary on most soils, as cauliflowers dislike acid conditions; furthermore, a soil which is sufficiently alkaline is a good precaution against the development of the club-root disease. Cauliflowers must be permitted to grow continuously or the curds or flowers will not develop properly. Seedling plants should be watered thoroughly and left for several hours before being planted out. A good ball of soil around the roots will then be retained. Dipping the plants in a solution of arsenate of lead and nicotine sulphate is recommended because of likely damage by aphides or caterpillars while the plants are becoming established.

Plants should be set out 18 to 24in. apart in rows 2ft. to 2ft. 6in. apart, according to the size of the variety.

If established plants are showing lack of vigour, side dressings of organic or inorganic manure in liquid or powder form will prove beneficial.

Varieties which mature in 3 to 4 months are All Seasons, Walcheren, Early London, and Early Snowball.

Spring Cabbage

In the milder northern districts a final sowing of spring cabbage may be made in March for spring harvestings. An open and sunny position should be selected for the seed-bed, although it should be sheltered from boisterous weather. In some districts it may be of advantage to sow seed under glass or in raised beds.

Cabbage plants from earlier-sown seed which have attained sufficient size may be planted out in their permanent positions. If plants have not been raised from seed, suitable ones could possibly be purchased. Where winters are mild plants usually take 16 to 18 weeks to reach maturity, but the growing period may be longer if temperatures are low and cultural conditions unfavourable. A sunny situation preferably with a northerly aspect should be chosen for autumn plantings.

The soil conditions and fertiliser mixture recommended for cauliflowers are also suitable for cabbage.

The chief objective should be to have strong, sturdy plants to put out and for them to have sufficient time to become established before winter sets in. Ground recently cleared of peas, onions, or potatoes is usually chosen for spring cabbage, and as it becomes available it should be thoroughly prepared as recommended for cauliflower.

Spring cabbage. The main object is to have strong, sturdy plants to put out in autumn and for these to have sufficient time to become established before winter conditions set in.

Varieties

Some popular varieties are Flower of Spring. Jersey Wakefield, and Early Offenham. Flower of Spring is the most adaptable and is very popular, particularly in southern districts. These varieties should be planted 15in. apart with 2ft. between rows.

Silver Beet

Silver beet or Swiss chard is a very useful crop which grows well in the cool conditions of autumn. In southern districts February is preferred for sowing for spring use, but early-March sowing is usually satisfactory if the young plants are able to become well established before the onset of very cold weather.

An application of 3oz. of lime per square yard is beneficial to the crop on most soils, as is a dressing at the same rate of blood and bone, or a mixture of 3 parts of superphosphate and

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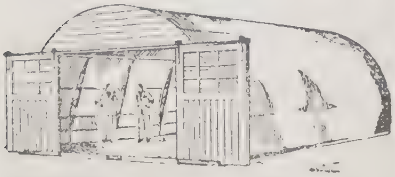

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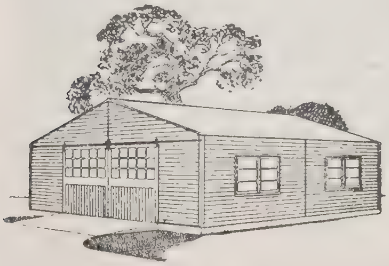

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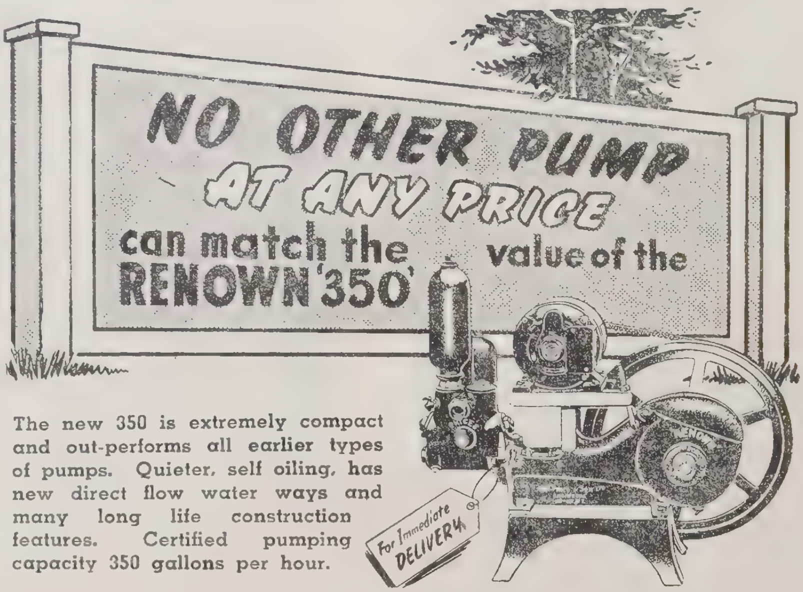

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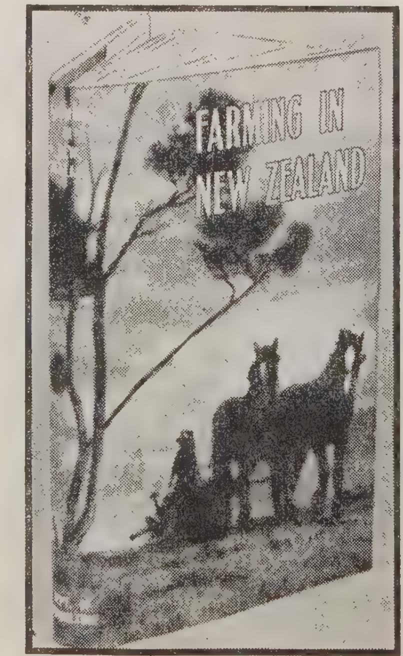

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1 part of sulphate of ammonia by weight. The manure should be broadcast and well worked into the soil before sowing seed or transplanting plants. Sow the seed ½in. deep in rows 18in. apart. Young plants can be thinned later to 9in. apart.

If plants are available from seed sown in January, they should be set out now, if this was not done last month. Silver beet plants are relatively easy to grow and are not as liable to insect attack as cabbages, etc. If a favourable start is made, good growth will be obtained before really cold weather is experienced. Select a well-drained part of the garden, as even this vegetable will not succeed in an unfavourable soil.

Varieties: Giant Lucullus and Giant Broad White Rib (Fordhook) are popular.

Spinach and Spinach Beet

A further sowing of prickly or winter spinach may be made now provided a well-cultivated and fertile soil is chosen. Good drainage is essential. Spinach beet produces fleshy leaves over a longer period than spinach. Spinach and spinach beet are rich in vitamins and with silver beet are a great standby when other greens are in short supply. If these crops have been overlooked, they should be sown without further delay, as it is advisable to have plants sufficiently well developed before winter frosts slow growth and for them to become sufficiently established to complete their development as soon as growing conditions improve in spring. For quick growth a dressing of the manure recommended for silver beet can be applied. It should be lightly worked in or watered in. For spinach beet, planting distances may be the same as for silver beet, but if prickly spinach is sown thinly, it should not require thinning.

Good varieties are: **Spinach**, Giant Prickly. **Spinach beet**, Perpetual Green Leaved and Spinach Beet.

Onions

As the adaptability of onions for cooking purposes makes them almost indispensable to the housewife, all gardeners who can afford the space should grow this crop.

Sowing

A sowing of onion seed may be made in the North Island in late March or early April for the production of plants which are usually set out in late July or early August. In the South Island onion seed is usually sown during late February or early March. However, in central and southern parts of the South Island autumn sowings are rather precarious and success depends to some extent on the season. In these areas early frosts sometimes "lift" and damage late-sown crops, and, if plants are sown early, with good growth they are liable to run to seed in spring before they have developed properly.

To obtain strong plants spread and dig in some well-rotted compost plus a dressing of 2 parts of superphosphate and 1 part of sulphate of potash by weight at 4oz. to the square yard. Raised seed-beds may be made to secure good drainage, and the ground used should be tramped firm.

[*Green and Hahn Ltd. photo.*

Toward the end of the season asparagus sometimes needs support. When top growth is developing the roots are storing up plant food for the next crop of spears.

Varieties: Pukekohe Long Keeper is perhaps the most widely grown variety, although Brown Spanish and Straw Spanish are quite suitable for autumn sowing.

Harvesting

If the past season's onion crop has not been lifted, every effort should be made now to get the onions out of the ground. No water should be applied and hoeing should cease. Bending over the tops, if it is necessary, will assist by checking the top growth and thus hasten maturity of the bulbs. To secure ripe bulbs dry conditions are very important. For easier removal of the bulbs the push hoe may be slid beneath them and they may then be laid out in windrows to dry completely. The keeping quality is greatly influenced by the care taken in harvesting and storing, which were discussed in last month's "Journal".

Potato Onions, Tree Onions, Shallots, Garlic

Potato onions, tree onions, and shallots, which are usually grown from bulbs, should be planted in autumn and early winter. Potato onions and shallots multiply from the roots as do tree onions, although as their name implies, the last also produce clusters of bulblets at the top of the stems. The onions at ground level do not keep well, but are useful for kitchen use in December and January; the small onions produced above ground may be used for pickling or may be planted again.

Garlic is used exclusively for flavouring. Small sets are planted during early winter and form clusters which may be harvested in December and January. They keep well if stored in a dry place.

Potato onions, tree onions, shallots, and garlic are planted shallowly. They may be pressed into the soil until they are about three parts buried and this allows for the consolidation of the soil. Plant bulbs 6 to 8in. apart with 12 to 15in. between the rows.

Potatoes

Main-crop potatoes should be permitted to mature in the normal way, and hoeing, weeding, and earthing-up should continue as long as the top growth remains healthy. However, if the potato crop has matured (indicated by the dying off of the top growth), there is nothing to be gained by leaving it undug. Diseased haulms should be removed and burnt before the crop is dug.

If possible, potatoes should be lifted in dry weather, giving them a few hours to dry. In districts where potato tuber moth is prevalent, however, they should be bagged as soon as possible; the unsealed bagged potatoes should not be left standing out overnight or covered with potato tops, as is commonly done, as this encourages moth infestation.

Dusting of potatoes in store with slaked lime or D.D.T. dusting powder acts as a protection against the moth.

Tomatoes

As the season progresses judicious leaf pruning of tomatoes near the fruits may be necessary on some late crops to assist ripening. There is little risk of sun scorch late in the season and the maturing fruit will need all the sunshine possible. Where birds are troublesome it may be necessary to remove fruit as soon as a change in colour is noticed. This is apparent at the base, where a pinkish yellowing takes place. Do not expose fruits in a window where the full heat of the sun will spoil them by scorching.

In milder districts where late crops are grown manurial side dressings and spraying may still need to be attended to.

As a side dressing equal parts of superphosphate and dried blood applied along the rows at 2oz. per square yard will prove beneficial, particularly at this time of year. Care should be

THE HOME GARDEN IN MARCH . . .

taken when applying the manure, which should be worked lightly into the soil, to prevent the manure from touching stems or foliage.

Applications of Bordeaux mixture or a suitable copper fungicide at about 14-day intervals are recommended for the prevention of fungous diseases. Where tomato stem borer, looper caterpillars, and other chewing insects are troublesome arsenate of lead can be added at the rate of 2oz. to 4 gallons of spray. For chewing pests D.D.T. 50 per cent. wettable powder at ½oz. in 4 gallons of water may also be used.

Lettuce

It is usual to transplant lettuce from an autumn sowing. Plants from seed sown in January and February should be put out as soon as possible so that they may become fairly well established before the severe weather sets in. To be tender lettuce must be grown quickly, and it is difficult to get quick growth in most gardens during late autumn and winter. Despite careful cultivation and frequent manuring the plants harvested are usually smaller due to the weather conditions. The ground should be well drained and deeply cultivated with much organic matter incorporated. Well-rotted stable or farmyard manure or compost should be dug in some time before planting.

In addition it is usually advisable to apply a fertiliser such as blood and bone at the rate of ¼lb. to the square yard, broadcast after digging and before planting. If growth appears slow about the time hearting is expected, weekly applications of liquid animal or fowl manure should be applied; or nitrate of soda (1oz. to the square yard) can be hoed in along the rows, taking care that it is kept away from foliage.

Though cos or romaine lettuce is not commonly grown in New Zealand, it is worth a trial, as its flavour is considered by many to be the best of all types. It is most suitable for an autumn sowing and winter crop, as it is extremely hardy. It is distinguished by its upright habit of growth, elongated head, and its stiff leaves. Self-folding varieties are now available. With them tying together of the leaves, which was necessary in the older varieties, is unnecessary unless the weather is very dry, when tying can be done easily by slipping rubber bands over the outer leaves.

Varieties of lettuce suitable for autumn sowing are Neapolitan, Winter Market, Imperial 615, Cos Improved, and Cos White.

Carrots

In northern districts where the growing period extends well into the autumn a sowing of carrots may be made now, if omitted last month, to produce young, succulent roots for early-spring use.

To ensure good seed germination a well-drained position should be chosen and the soil should be worked down to a fine tilth. Where drainage is not considered satisfactory production on raised beds is advisable. If possible, the sowing should follow a crop such as cabbage which has previously been heavily manured. If it is thought necessary to add an additional fertiliser, superphosphate and sulphate of potash in equal proportions at 2oz. per square yard will give good results. Seed should be sown thinly ½in. deep in heavy soils to ½in. deep in light soils in rows 12in. apart.

As plants seldom grow to their full size when sown at this time of year, thinning may be regulated according to the progress made by the plants. Thinning to 2in. between the plants may be sufficient in most instances.

Varieties: The following are recommended for autumn sowing: Early Horn, Scarlet Horn, Early Crop, and Chantenay.

Pumpkins, Marrow, and Squash

The harvesting of pumpkins, marrows, and squash will now be progressing in some districts. Even comparatively light frosts which do not appear to affect the fruits may cause minute injuries and so provide a congenial environment for the development of fungous diseases. When removing the fruits leave 3 to 4in. of stem, because if stems are broken off or cut too close to the fruits, disease is likely to gain entry there during storage. For storing, select fruits which have skins sufficiently hard that the pressure of the thumb nail will not penetrate them. As final harvesting approaches excess growths should be continually pinched back to assist maturity of fruits. If conditions are inclined to be wet, it may be desirable to keep some fruits off the ground by placing a piece of flat board carefully beneath them.

Kumaras

Kumaras will be nearing maturity and during March the main work will be in preventing the vines rooting at the nodes. This may be done by occasionally raising them by hand or with a hoe or rake handle.

Sweet Corn

Sweet corn will be maturing quickly and it should be harvested at the correct time; that is, when it is in the "milk" stage, as the edible quality is then at its best. It will be found that at that stage the kernels yield a milky juice if punctured. The silk on the cobs should be brown and drying off and the ears should feel firm and plump.

The flavour of sweet corn is best when cobs are cooked within 24 hours of picking. Later plantings of sweet corn may still require staking or earthing up.

Peas, beans, tomatoes, and cucumbers should be picked regularly as this extends production.

Fruit Crop Estimates for December, 1950

THE following estimates of the fruit crop for December, 1950, in 000's of bushel cases, are provisional and revised monthly for the period November to March and are summarised from information supplied by field officers of the Horticulture Division, Department of Agriculture.

FRUIT	DISTRICT									
	Auckland	Gisborne	Hawkes Bay	Manawatu Wanganui	Wairarapa	Nelson	Marlborough	Canterbury North Otago	Central Otago	Total
APPLES—										
Ballarat	48	6	60	2	1	8	3	9	1	138
Cox's Orange Pippin ..	8	3	50	1	1	132	13	14	11	233
Delicious	16	7	80	1	5	173	27	25	40	374
Dougherty	18	5	50	—	—	23	2	—	—	98
Granny Smith	63	3	80	2	3	79	2	3	5	240
Gravenstein	20	—	30	—	—	57	1	1	1	110
Jonathan	8	—	40	—	1	243	24	16	32	364
Sturmer	3	5	150	5	15	354	27	49	32	640
Other varieties	86	4	123	4	5	143	19	49	45	478
Total	270	33	663	15	31	1212	118	166	167	2675
PEARS—										
Beurre Bosc	5	1	3	—	—	9	—	—	—	18
Louise Bonne de Jersey .	1	—	15	—	—	—	—	—	1	17
Packham's Triumph ..	5	—	4	—	—	3	—	—	—	12
P. Barry	2	1	10	—	1	4	—	1	—	19
W. B. Chretien	11	—	45	—	—	35	—	3	8	102
Winter Cole	2	1	65	—	2	34	1	6	3	114
Winter Nelis	—	—	30	—	—	10	—	3	5	48
Other varieties	15	1	8	2	—	10	1	9	4	50
Total	41	4	180	2	3	105	2	22	21	380
OTHER FRUITS—										
Peaches	68	3	238	1	—	55	5	9	74	453
Apricots	1	—	4	—	—	1	—	11	71	88
Nectarines	—	—	20	—	—	1	1	1	17	40
Plums	42	5	51	1	1	12	2	5	30	149
Cherries	—	—	1	—	—	—	2	3	12	18
Quinces	1	—	8	—	—	10	—	—	1	20

Functions of the Green Leaf in Fruit Production

THE importance of the green leaf to primary production as a whole and to the fruit-growing industry in particular is not always appreciated. In this article G. S. Northcote, Orchard Instructor, Department of Agriculture, Nelson, explains the functions of the green leaf in fruit production and the need for having a maximum amount of healthy foliage on a fruit tree.

AN examination of the normal fruit tree leaf shows a broad, flat surface with a main vein, commonly called the midrib, and many smaller veins branching all over the leaf so that every portion of the leaf is served by the system of veins. The functions of these veins is to carry water and mineral salts to every part of the leaf and to take away the food manufactured in the leaf to other parts of the plant requiring it—the fruit, the growing points, and the roots. An examination of the underside of the leaf with a microscope reveals numerous stomata or breathing pores. Each stoma is enclosed with two guard cells, and it is through these stomata that the gases of the air enter the leaves. The guard cells open and close the stomata according to the requirements of the leaf. As a rule they are open wide in the morning and evening and may be closed during the heat of the day and at night.

If a cross-section of the leaf is examined under a microscope, the following tissues are plainly seen:—

1. The upper epidermis with cuticle to prevent the loss of moisture to the air.

2. A layer of palisade cells, which are packed with chloroplasts containing chlorophyll.

3. Open, spongy mesophyll tissue with many air spaces through which gases and moisture can circulate freely. Through the mesophyll run the veins, which have a vascular bundle containing xylem and phloem cells.

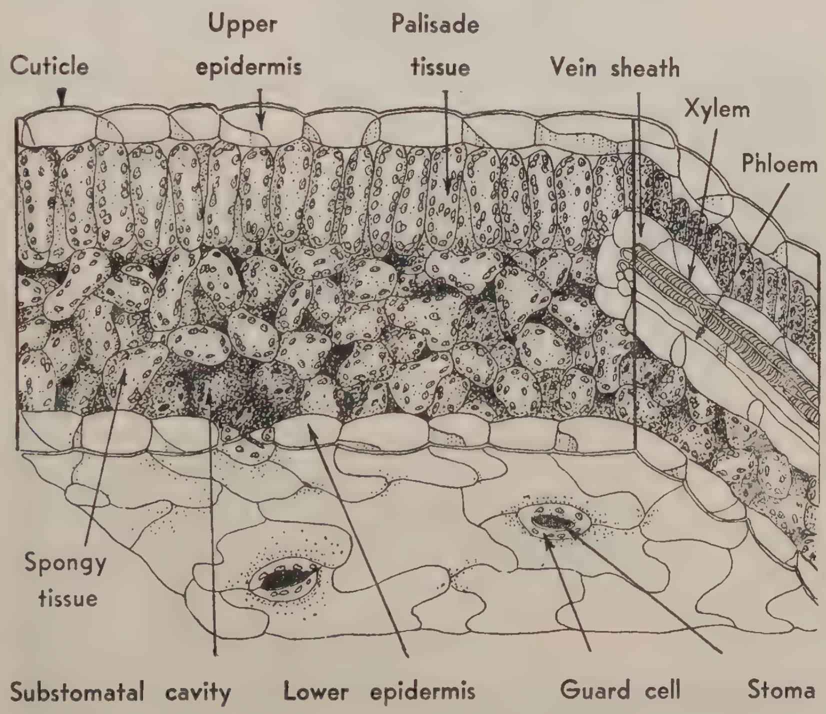
4. The lower epidermis with stomata.

Formation of Sugars

The main function of the green leaf is photosynthesis or "light building". It has been shown that water enters the leaves through the veins, and the gases of the air, including carbon dioxide, enter through the stomata. These two essential materials diffuse into the cells containing chloroplasts, where in the presence of sunlight they are formed into complex carbohydrates and sugars such as glucose, fructose, and sucrose. It is only in the green leaf that these sugars can be manufactured, and the many attempts made to manufacture them synthetically have failed.

[*Ministry of Works photo.*

A good covering of healthy foliage should be maintained on trees throughout the growing season.



Schematic diagram of portion of a sunflower leaf, showing internal structure.

It is easy to prove that water, carbon dioxide, chlorophyll, and sunlight are all essential to the manufacture of the carbohydrates by conducting experiments and omitting each in turn. Without all four ingredients no sugars are manufactured.

Under optimum conditions the sugars are manufactured so quickly that they cannot diffuse from the cells to the veins and so to other parts of the plant. Therefore to remove them from the system of the plant they are changed into starch and stored in the cells until night, when the starch is converted back to sugars and carried through the vein system to other parts of the plant. This article does not deal with stem structure and it is not proposed to explain in detail how the food travels round the tree. It is sufficient to state that the xylem or wood cells carry water and necessary mineral elements up the stem to the leaves, and the phloem or bast cells carry the sugars from the leaves to the fruit, growing points, and roots. These cells are continuous through the roots, stem, and into the leaves by means of the veins.

Importance of Healthy Foliage

Other functions of the leaves are transpiration and respiration, whereby all the excess water and gases are expelled through the stomata. Healthy foliage is just as important for the following season's crop too, because a plentiful supply of food manufactured one year ensures plump, well-filled

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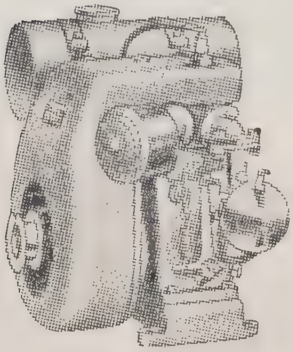

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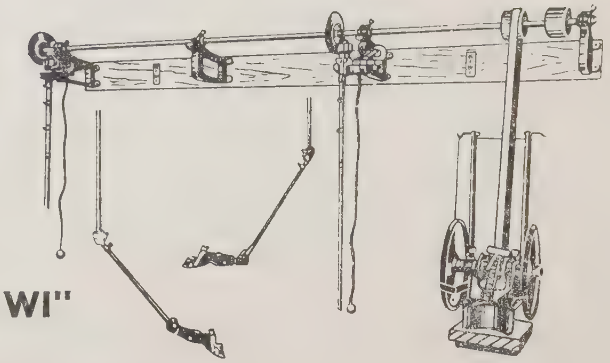

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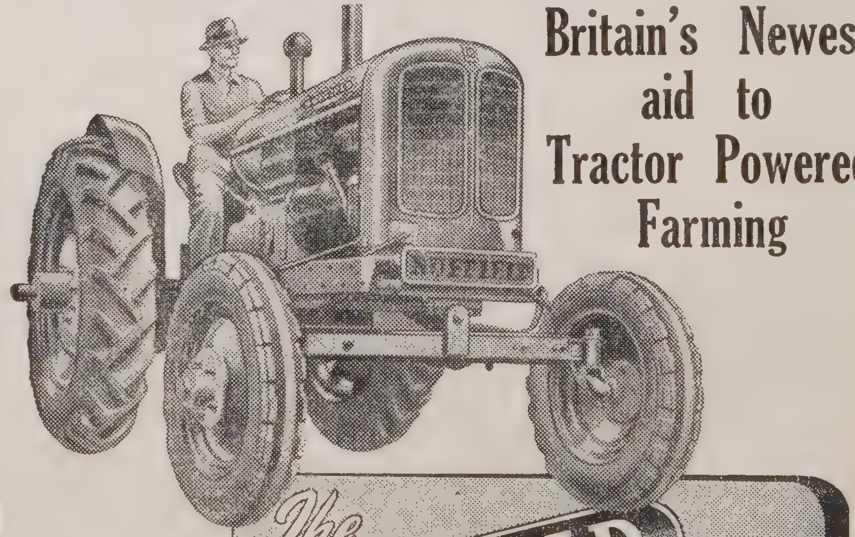

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buds for the following season's fruit and also makes strong, healthy young wood, which is necessary to all friut trees.

The main problem of fruit growing is to maintain a good covering of healthy foliage on the tree throughout the growing season. A good mark at which to aim is to have 50 healthy leaves for every fruit allowed to mature. To achieve this, attention must be paid to the following points: 1. Drainage, 2. cultivation, 3. fertilisers, 4. pruning, 5. spraying, and 6. thinning. Articles about all these subjects have appeared in the "Journal" and it is not proposed to review them in detail. However, a brief review of the main points is well worth while.

Fruit trees must be planted in well-drained soil. Although it is often stated that some trees such as plums can be planted in wet places, they must not be planted where water lies for any length of time.

Clean Cultivation

The best method of cultivation is to maintain clean cultivation between September and January (October and December in Central Otago) and to sow cover crops in January to build up the humus content of the soil. These cover crops should be disced in during late winter.

Sod culture is not suitable in New Zealand unless there is a plentiful supply of water for irrigation. The grass competes with the trees for moisture and plant nutrients, with the result that the leaves do not receive sufficient water to carry out their normal functions. Deep cultivation is unnecessary and the cultivators should be used only as often as is necessary for good control of weed growth.

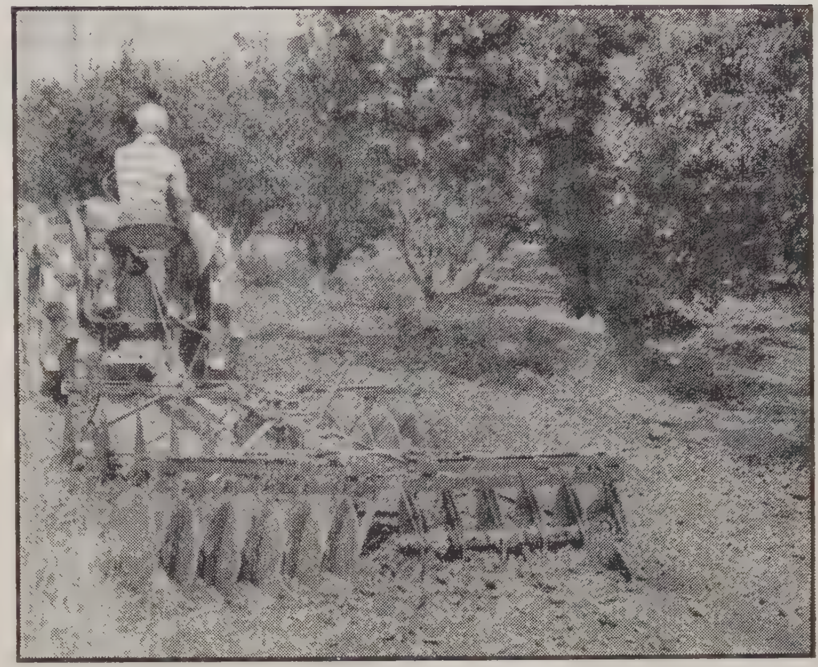
There is no quicker way to destroy the humus content of the soil than constant and unnecessary cultivation.

Use of Fertilisers

Fertilisers must be used to maintain healthy foliage. All New Zealand soils need phosphates, and most fruit trees require potash. The need for nitrogen applications will vary according to cultural practices, but all fruit trees require a large amount of nitrogen at fruit-setting time. Deficiencies of various essential elements in the soil are always quickly reflected in the leaves of fruit trees, so to maintain healthy foliage all the nutrients required by the trees must be supplied to them.

Pruning is necessary to maintain the trees in a healthy growing condition, and skill is required to keep the correct balance between growth and fruit. Pruning too hard will induce an abundance of wood growth with very little fruit. The leaves cannot feed both luxuriant wood growth and heavy fruit crops.

Spraying has to be done to combat both fungous diseases and insect pests, and a regular spray programme must therefore be maintained throughout the growing season. The good commercial grower applies as many as 12 sprays to his trees between August and March.



[National Publicity Studios photo.

The discing in of cover crops during late winter will build up the humus content of the soil.

Fungous diseases such as powdery mildew, black spot, brown rot, leaf rust, leaf curl, and shot-hole cause loss of healthy foliage. Insect pests such as leaf hopper, aphides, scales, and red mites suck out the life blood of the leaves, and those like codling moth, leaf roller, and bronze beetle cause damage to both fruit and foliage. To maintain the foliage of fruit trees in a healthy condition the trees must be sprayed even when too young to bear fruit and also in the seasons when for some reason they are bearing no crop.

Value of Thinning

The thinning of young fruit is another important practice not only to obtain good-sized fruit but to maintain the thrift of the tree. The foliage cannot be expected to manufacture sufficient food to mature every fruit that is set and at the same time feed new growth and the next season's fruit buds. Thinning should be done as early as possible in the season to ease the strain on the tree. Apples and pears should be thinned down to doubles or even singles, and peaches and nectarines should have at least 4in. of space between each fruit. Plums can be well spaced out on the limbs according to the size of the variety. With stone fruit especially, no fruit should touch another. Allowing space so that fruits do not touch will not only save broken branches and produce good-sized fruit, but will also assist the maintenance of healthy foliage, disease control, and the production of a good crop the following season.

It cannot be too strongly emphasised that the foliage on a fruit tree is not merely ornamental, but is essential to the production of good fruit crops. Officers of the Horticulture Division are always ready to give detailed advice on the cultural practices which are necessary to keep the trees covered with healthy foliage.

◆

REGISTRATION OF
DAIRY FACTORY MANAGERS

Intending applicants are hereby notified that applications for registration under the Dairy Factory Managers' Regulations should reach the Registrar, Dairy Factory Managers' Registration Board, c/o Department of Agriculture, P.O. Box 3004, Wellington, on or before April 1, 1951. Forms, are available from the Registrar.

Attention is drawn to the fact that any application which is received by the Board after April 1, 1951, shall not, except in special circumstances, be considered by the Board until after April 1, 1952.

E. M. EDGECOMBE,
Registrar.

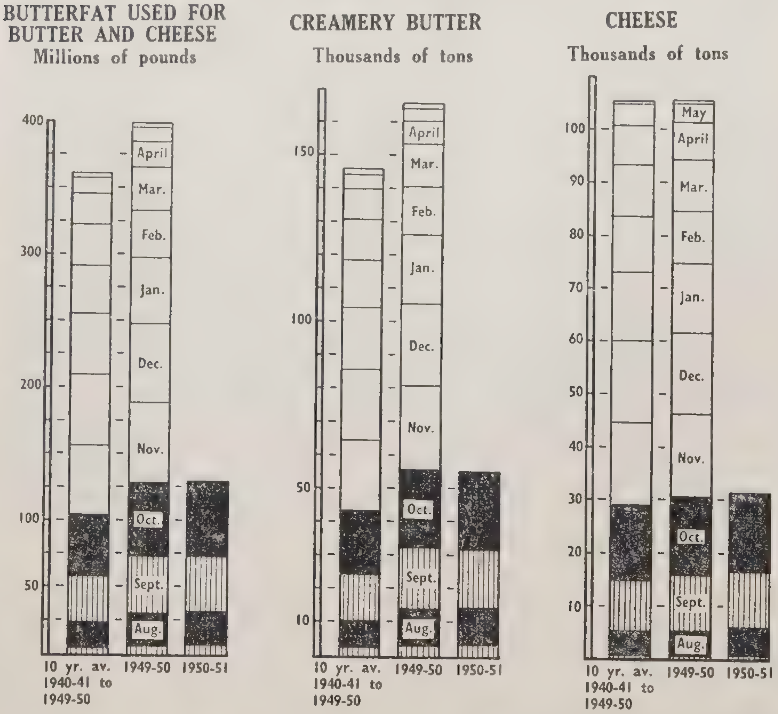
N.B.—*This notice refers to persons who are NOT AT PRESENT HOLDERS OF CERTIFICATES. Notice of renewal and renewal form will be posted to every registered manager by the Registrar.*

PRIMARY PRODUCTION REVIEW

From data supplied by the Statistical Section, Extension Division, Department of Agriculture, Wellington.

NEW ZEALAND DAIRY PRODUCTION, 1950-51 (Factory Production Only)

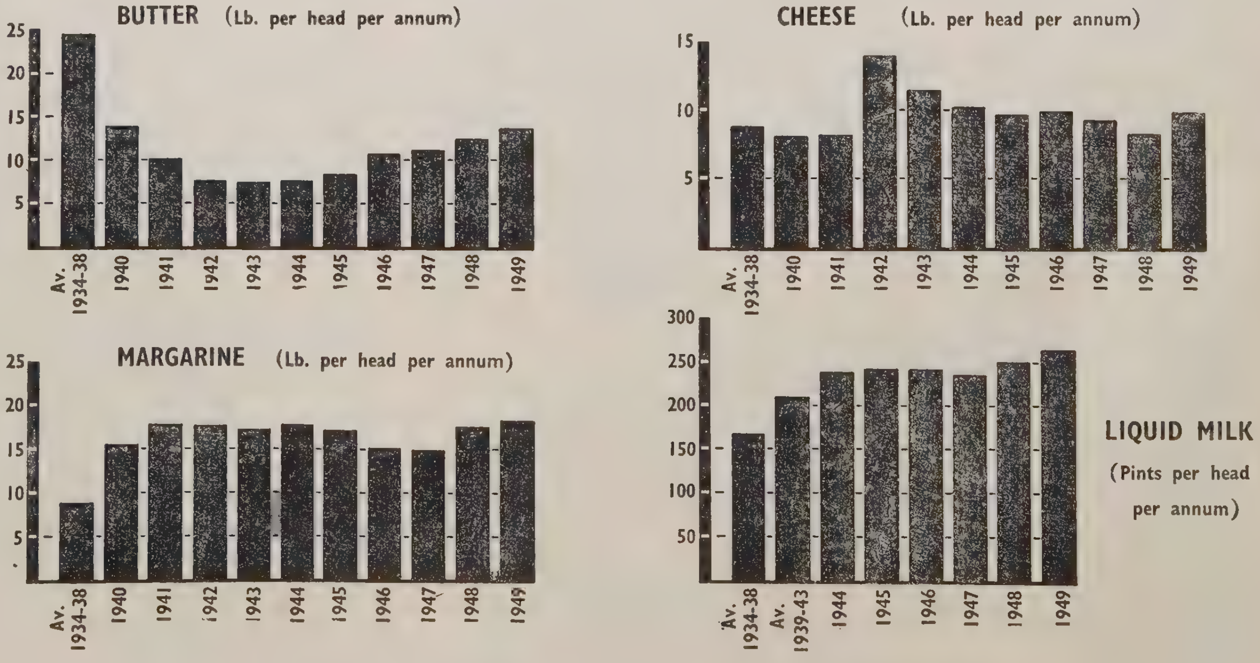
Season July 1 to June 30: Order of months July to June reading upward in each column



Present Season.—Information collected to date indicates that dairy production for the 1950-51 season should reach a fairly high level. A very good start was made, July figures being well above those of the corresponding month in 1949-50 and August production being slightly above the high figure reached the previous year. Warm, dry weather resulted in production for September being slightly lower than for that month in 1949, but this was compensated for in October, when there were good rains and production reached a new record for October. Pasture growth and production were generally good during November, but dry weather was experienced in some of the major dairying districts during December and production for the latter month will have been affected accordingly. Rain during January made prospects for that month good, and if conditions are average during February and March, it seems likely that total dairy production will exceed the record figure of 1949-50.

UNITED KINGDOM CONSUMPTION

Changes in per-head consumption of dairy products and margarine



Source: Mainly Commonwealth Economic Committee data; 1949 data provisional.

Pasture Mixtures: Harvesting Red Clover

SEASONAL NOTES Contributed by the EXTENSION DIVISION

PREPARATION of land for autumn-sown pastures should now be well advanced and careful attention should be given to the selection of the seeds mixture. Certified strains of the more important grasses and clovers are available to farmers. These strains have been selected and bred to suit New Zealand conditions and should always be sown in preference to uncertified seed. Seed certification is a guarantee of type, the main features being high production and longevity, both of which are important where pastures are to last for many years. Field officers of the Extension Division of the Department of Agriculture are available throughout the country to advise about seeds mixtures.

RYEGRASS AND WHITE CLOVER

Ryegrass and white clover form the basis of most permanent pasture mixtures. Under conditions of high fertility this combination produces a large amount of nutritious feed and is able to withstand heavier grazing for a number of years than can any other combination of high-producing pasture plants. Though seeding rates vary considerably, the most usual is 30lb. of perennial ryegrass and 2lb. of white clover per acre.

COCKSFOOT AND PASPALUM

In many districts production from ryegrass drops in the dry summer months. Both cocksfoot and paspalum are able to fill in this gap in production and should be sown in districts where ryegrass production slumps in summer. Cocksfoot will grow in most parts of New Zealand, but paspalum is of value only in the warmer districts such as Northland and the Bay of Plenty. When either cocksfoot or paspalum is sown it is advisable to reduce the seeding of perennial ryegrass to no more than 25lb. per acre. Cocksfoot is usually sown at up to 8lb. per acre (with even the present high price for seed it should not be omitted from mixtures for drier types of land, though 3 to 5lb. may be sufficient) and paspalum at 5lb. per acre. Paspalum may also be introduced into a pasture by feeding out "seedy" hay. As neither of these grasses establishes as rapidly as ryegrass, hard grazing in the early stages should be avoided.

TIMOTHY AND MEADOW FOXTAIL

Timothy and meadow foxtail are valuable pasture plants where conditions are too wet for ryegrass to thrive. Improved strains of timothy are available, but seed of meadow foxtail is not readily obtainable commercially at present. Both of these grasses are sown at 5lb. per acre.

SHORT-ROTATION RYEGRASS

Short-rotation ryegrass can be included in all permanent pasture mixtures on rich land. It will last for many years under rotational grazing, but will die out within 2 years under set stocking with sheep. Its main value is in its winter and spring production, and full advantage of this may be taken in the break feeding of winter-saved grass on dairy farms. On rich country about half of the ryegrass sown should be short-rotation ryegrass. On country where it will not last as long the amount used should be reduced to 5lb. per acre.

IMPORTANCE OF CLOVER

Pasture production is governed largely by the amount and vigour of the clover in the sward. Clover not only assists the grass to produce but also adds considerably to the food value of the herbage. For permanent pastures four plants are of particular importance: On well-drained, fertile soils white clover is both permanent and high producing and should be sown in all mixtures at the rate of at least 2lb. per acre; where conditions are too dry for white clover to survive subterranean clover should be sown at from 2 to 4lb. per acre; on very wet country strawberry clover will thrive where white clover will not grow; and on hill country in high-rainfall areas *Lotus major* may be included at 1lb. per acre.

A young pasture of perennial ryegrass and red and white clovers. Pasture production is governed largely by the amount and vigour of the clover in the sward, particularly in the early stages of establishment.

* * *

HARVESTING RED CLOVER SEED

RED CLOVER seed is harvested mainly in March and April. The crop normally ripens fairly unevenly, and for this reason it is usually cut 10 to 14 days before it is picked up with a header harvester or threshed with a clover huller. Cutting too soon results in a high proportion of green, immature seed in the sample. Good colour is obtained by cutting later, when a high percentage of dark-coloured seed will be produced.

DIRECT HEADING

Red clover is often direct headed in localities where winds of gale force are likely to occur at harvest time, for in such districts a slightly reduced annual yield is considered better than occasional complete losses caused by wind after the crop has been cut. Light crops on the drier soil types may also be direct headed conveniently, as ripening of the seed heads is more even under these conditions.

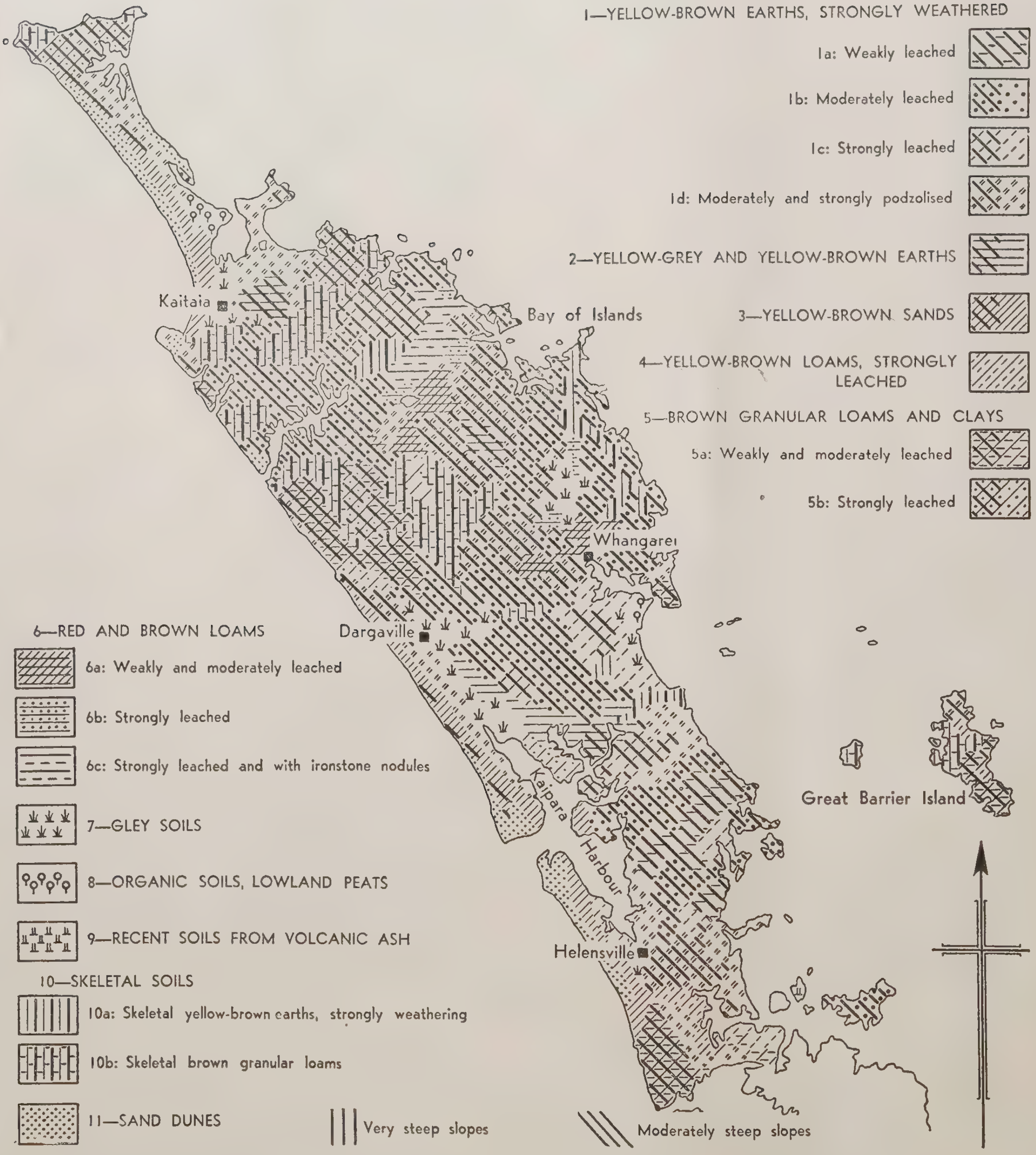
THRESHING CONDITIONS

Threshing conditions are of great importance, and much good red clover seed may be lost or damaged through an endeavour to get the seed safely in the bag at the earliest opportunity. Within reason, using normal header settings and awaiting satisfactory weather is better than endeavouring to "squeeze" the seed out with unwise header adjustments when the crop is not "fit". Advantage should be taken of the ideal north-west conditions while they last and threshing avoided in the early forenoon and late afternoon when conditions make dislodging of the seed difficult.

REMOVING RUBBISH

After threshing it is advisable to remove the straw from the paddock. The large amount of straw left from bulky crops in particular after the passage of the header harvester has a smothering effect on the covered clover, as well as providing cover for the activities of grass-grubs and porina (*Oxycanus*).

SOIL TYPES OF THE NORTHLAND DISTRICT


1—YELLOW-BROWN EARTHS, STRONGLY WEATHERED
1a: Weakly leached
1b: Moderately leached
1c: Strongly leached
1d: Moderately and strongly podzolised
2—YELLOW-GREY AND YELLOW-BROWN EARTHS
3—YELLOW-BROWN SANDS
4—YELLOW-BROWN LOAMS, STRONGLY LEACHED
5—BROWN GRANULAR LOAMS AND CLAYS
5a: Weakly and moderately leached
5b: Strongly leached
6—RED AND BROWN LOAMS
6a: Weakly and moderately leached
6b: Strongly leached
6c: Strongly leached and with ironstone nodules
7—GLEY SOILS
8—ORGANIC SOILS, LOWLAND PEATS
9—RECENT SOILS FROM VOLCANIC ASH
10—SKELETAL SOILS
10a: Skeletal yellow-brown earths, strongly weathering
10b: Skeletal brown granular loams
11—SAND DUNES
Very steep slopes
Moderately steep slopes
Kaitaia
Bay of Islands
Whangarei
Dargaville
Kaipara Harbour
Helensville
Great Barrier Island

Recommendations for the topdressing of pastures on each soil type in Northland with lime and fertilisers, based on results of a series of observational trials, are given in this article.

Topdressing of Pastures in Northland

NOT until little more than 20 years ago did the topdressing of pastures in Northland become at all general, and in that period dairy production has more than doubled and other farm production has increased by about three-quarters. Ample scope still exists for increased use of fertilisers and lime in the district, and in this article E. H. Arnold, Assistant Fields Superintendent, Department of Agriculture, Auckland, analyses the results of trials and suggests how the knowledge gained may best be taken advantage of.

THAT long peninsula the greater portion of which is now known as Northland, with its hilly and rolling country originally clad in forest and scrub and its many river flats in bush and swamp plants, is suited to grassland farming because of its climate. Of the total 3,328,000 acres, about 2,663,000 acres are occupied, of which the area in sown grass is 1,470,000 acres. Grassed areas on flat land cover about 240,000 acres, on easy and rolling or undulating land 630,000 acres, and on moderately steep to steep country 600,000 acres.

Grassland farming within the area consists of dairy farming and fat-lamb raising, with some stock fattening mainly on the flat and undulating land and the more extensive types of sheep and cattle grazing on the hilly land. Of many problems facing Northland farmers perhaps the major one is topdressing. Dairy farming and fat-lamb raising areas receive by far the greatest proportion of the topdressing applied. Hill country on which run stock are grazed is topdressed infrequently and usually only when economic and labour conditions are favourable.

Regular topdressing of pastures with phosphatic fertilisers has been customary in established dairy-farming and fat-lamb raising districts for many years. At first fertilisers were usually applied in winter and early spring, but later the general time of application was altered to early autumn, with the effect of increasing the winter growth of pasture and giving a more even growth throughout the year.

Heading photograph by Sparrow Industrial Pictures Ltd.

Topdressing Trials

Between 1928 and 1949 more than 130 observational topdressing trials were laid down in Northland. Originally the experiments formed part of a Dominion-wide survey of pasture responses to topdressing and were aimed at securing information about possible responses on different soils to lime, superphosphate, and potash, alone or in combination. In certain trials forms of phosphates other than superphosphate have been included. Under the soil and climatic conditions in Northland non-water-soluble forms of phosphate have a place. Thus the standard trial now laid down carries further the survey of responses from superphosphate, potash, and lime, and in addition gives evidence of possible results to be obtained from the other common forms of phosphatic fertilisers.

The present layout of the plots, laid down in duplicate on one soil type in one field, is shown in the diagram on this page. All forms of phosphates are applied at the rate of 3cwt. per acre annually, potash in the form of 30 per cent. potash salts at 2cwt. per acre annually, and ground carbonate of lime usually at 1 ton per acre for the initial dressing, followed by 5cwt. per acre annually. In some of the recent trials 1cwt. per acre of muriate of potash has been used in place of 30 per cent. potash salts, which at times has been unobtainable.

Observations are made at intervals of about 3 months and responses are indicated by a system of points, as follows: 0 to indicate no visible difference from "no fertiliser"; ?, a doubtful difference; 1, a slight difference; 2, a fair difference; 3 a good difference; 4, a very good difference; and 5, an excellent difference. Half points are also used—for example, 1½ indicates a slight to fair difference—and if a treatment depresses the sward below the standard

No-fertiliser surround

Basic superphosphate	Serpentine superphosphate	Superphosphate	Superphosphate + potash	Heskett slag	Basic slag	North African phosphate
Basic superphosphate + lime	Serpentine superphosphate + lime	Superphosphate + lime	Superphosphate + potash + lime	Heskett slag + lime	Basic slag + lime	North African phosphate + lime

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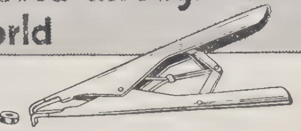

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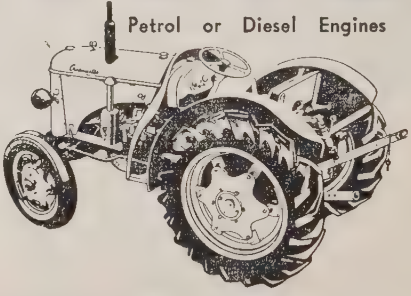

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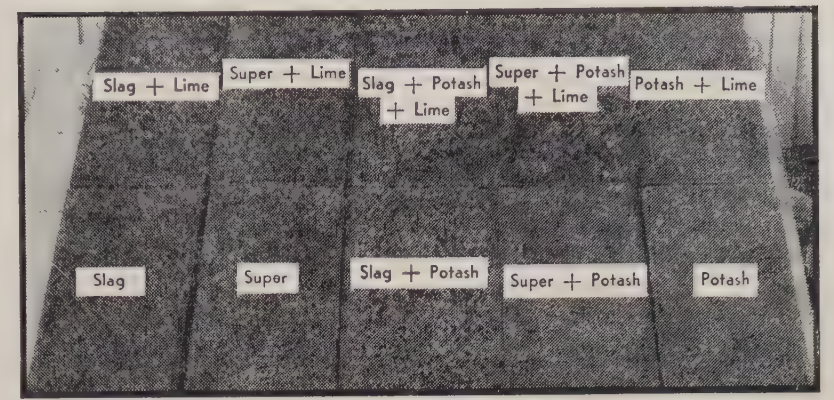

A replica of a trial on Ruatangata clay loam.

of the "no-fertiliser" area, the appropriate points are preceded by a minus sign. Brief notes are also recorded. Differences in growth and botanical composition and changes in sward constituents (especially of the clovers), preferential grazing, and colour are considered. Each trial is carried on for at least 3 years, and in some instances experiments have lasted 7 to 8 years.

Before soil types were classified and mapped by the Soil Bureau of the Department of Scientific and Industrial Research the soils on which the trials were laid down were described as gumlands of various kinds, clays, clay loams, sandy loams, sands, volcanic soils, alluvial soils, etc. However, when each trial was laid down detailed maps and plans of the exact location of the plots were compiled. As the soil types were named by the Soil Bureau it was possible to record the new soil name involved. For trials laid down more recently the soil name has been available. All the experimental data gained over the years in Northland have now been correlated with the new soil classification and type names. A general account of North Island soils written by L. I. Grange, Director of the Soil Bureau, was published in the "Journal" for April, 1945.

Soils on volcanic land in Northland are the brown loams and ironstone soils derived from basalt rock flows and red loams from basalt scoria; and the brown granular loams and clays derived from andesite and dolerite rock.

The basalt volcanic soils (6a, 6b, and 6c) occur mainly near Whangarei and cover considerable areas in Bay of Islands County. The young and immature types of brown loams and red loams which have been little or only weakly leached are the more fertile, but some are rather shallow and bouldery for good pasture. At the time of the first European settlement these soils were covered in broadleaf forest, chiefly taraire but with puriri in some locations. The semi-mature or moderately leached brown loams are less fertile. The natural vegetation ranged from broadleaf forest, taraire, and to a less extent puriri, to totara and even kauri on the more strongly leached types, some of which were covered by fern and scrub. The mature or strongly leached basaltic soils, known as ironstone soils and occurring in the Bay of Islands, were covered by low scrub, mainly manuka. During years of indiscriminate burning this manuka has been invaded by prickly hakea and to a smaller extent by gorse.

The brown granular loams and clays (5a and 5b) cover large areas, mainly of hill land, in Hobson, Whangarei, Hokianga, and Mangonui Counties. Those derived from dolerite which form the higher and steeper hills are rather better soils than those from andesite on the adjacent lower slopes and rolling to strongly rolling country. The young and immature types, mainly from dolerite, in general have granular, free topsoils. The natural vegetation consisted of mixed forests of taraire and puriri, with some kohekohe, karaka, and, where leaching was more advanced, rimu, rata, totara, and towai. The semi-mature and more leached soils formed from andesite and in some cases complexes with basalt and dolerite have subsoils which are more compact. Totara and kauri forest formed the natural cover. After the bush was felled scrub and fern reclothed these hills. More leached or later semi-mature types grew scrub, fern, and wiwi rush.

SUMMARY OF RESPONSES TO TOPDRESSING ON EASY, ROLLING, AND HILLY VOLCANIC LAND IN NORTHLAND

(O. no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent)

SOIL TYPES	UNLIMED							LIMED						
	Superphosphate	Serpentine superphosphate	Basic slag	Heskett slag	North African phosphate	Superphosphate + potash	Basic slag + potash	Superphosphate	Serpentine superphosphate	Basic slag	Heskett slag	North African phosphate	Superphosphate + potash	Basic slag + potash
BROWN LOAMS (from basalt flows)—														
Young to immature (more fertile):														
Kiripaka loam	1½		2			1½	2½	2½		3			3	3½
Ohaeawai bouldery loam ..	1					1½		2					2½	
Whatitiri clay loam	1½		2			2	2	2½		3			3½	3½
Whakapai loam and clay loam	1½		2½			2	3	2½		3½			3½	4
Semi-mature (less fertile):														
Waiotu clay loam	1½		3			2	3½	2½		3			3½	4
Matarau clay loam	½		2½			½	2½	2		3½			2½	4
Kerikeri clay loam	½		2			1	2½	2½		3			3½	4
Ruatangata clay loam ..	1½	1½	2½	½	1½	2	3	3½	3½	4	1	2	4	4½
Mature (ironstone):														
Okaihau gravelly loam ..	½	1	1½	½	1	3½	4	2	2½	2½	1	1½	4	4½
RED LOAMS (from basaltic scoria)—														
Young to immature:														
Maunu loam	2					2½		3					3½	
Waimate North clay loam ..	1½		3½		1	1½	3½	3		4½		1½	3½	4½
BROWN GRANULAR LOAMS AND CLAYS (Semi- or light volcanic)—														
Young to immature:														
Takitu clay loam		1½							3					
Katui clay loam	½	1½	1½	½	1½	1	2	3½	3½	4		3	4	4½
Semi-mature:														
Whatoro clay	2½					3		4					4½	
Later semi-mature:														
Awarua clay	1	1	3	½	2	1½		4					4	

SUMMARY OF RESPONSES TO TOPDRESSING ON ALLUVIAL FLATS AND PEATY AREAS IN NORTHLAND

(O, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent)

SOIL TYPES	LOCAL OR COMMON NAME	UNLIMED						LIMED					
		Superphosphate	Serpentine superphosphate	Basic slag	North African phosphate	Superphosphate + potash	Basic slag + potash	Superphosphate	Serpentine superphosphate	Basic slag	North African phosphate	Superphosphate + potash	Basic slag + potash
RECENT ALLUVIUM—													
Whakapara mottled clay loam	Clay river flat or clay alluvial	1	1		½	½		1½	1½		1	1½	
CLAY OR MEADOW SOILS—													
Kaipara clay and clay loam	Alluvial clay flats	2	2½	3	2	2	3	3½	4	4	2½	3½	4
Kaitaia clay loam	Alluvial clay flats	1½		3	3½	1½	3	3		3½	4	3½	4
Waipu clay	Alluvial clay flats	1				1		3½				4	
TERRACE ALLUVIUM—													
Waipuna clay	Clay gumland flat	½				1		4				5	
Kara silt loam	Gumland flat	2½		3	1½	2	3½	4½		3½	2½	4½	4
Kohumaru clay	Semi-volcanic flat	1	2	3½	2	1½	2½	4	4	4	3½	4½	4½
Kohumaru mottled clay ..	Semi-volcanic flat	1½		2½		1½	3	2½		3		3	3½
Pakotai clay	Semi-volcanic flat	?		2	½	½	2	4½		4		5	4
PEATS—													
One Tree Point peaty sandy loam	Peaty sand	1½		2		2½	3	3		3		4	4½
Parore peaty sand	Peaty sand	4				4		4				4½	
TIDAL FLATS—													
Takahiwai clay and sand ..	Tidal flat	1½						3					

Recommendations

In general the greatest responses on the soil types in these areas have been obtained from applications of basic slag plus lime plus potash. Then closely follow the responses from superphosphate plus lime plus potash and basic slag plus lime. On most types superphosphate plus lime has caused a response greater than that from basic slag, but less than that from basic slag plus lime. On the more matured or more leached soil types the improvement caused by liming is greater than on the less mature types.

The flattish, easy, and rolling volcanic land which at present receives fertiliser is almost all used for dairy farming and fat-lamb production. On such areas where the lime content of the soil has not already been sufficiently built up heavy initial applications of up to 1 ton of lime per acre are necessary. As on all soil types requiring lime, it should be applied before further applications of phosphates. Subsequent annual dressings of 4 or 5cwt. per acre will maintain the lime status of the soil. Phosphates are best applied at 3cwt. per acre annually in early autumn. Whether superphosphate or serpentine superphosphate is applied instead of basic slag will depend on the cost and on the tendency of a quick-acting phosphate such as superphosphate to induce winter growth, but the margin in favour of basic slag appears great enough to overcome these factors. The addition of 1cwt. per acre of potash salts will further increase the responses from topdressings of lime plus phosphate and appears payable. Some of this volcanic land is so situated that lime would be uneconomic to buy, transport, and apply, and on such areas 3cwt. of basic slag per acre would be very beneficial.

Only a small proportion of the moderately steep and almost none of the steep volcanic land in grass and used for grazing sheep and cattle is topdressed. Some of the moderately steep land within reasonable cartage distance of lime supplies, and which has been suitably roaded, will produce best if, as well as the introduction of clovers into the sward, it is given dressings of 1 ton of lime every 3 or 4 years and applications of phosphates, particularly basic slag, every 1 or 2 years. On areas where the "applied" cost of liming is not economic, applications of 4cwt. per acre of basic slag or North African phosphate every 2 or 3 years will prove sound practice.

Flat land in the Dargaville district where the soil type is Kaipara clay and clay loam.

Limestone country in the Arapohue district.

Alluvial Flats and Peat Areas—7 and 8

Recent alluvial soils, subject to periodic flooding, which adds new material, occur in the narrow valley bottoms alongside the numerous creeks and rivers throughout the area. In general, they are of two types, one with soil from volcanic hills and the other with soil from sedimentary rocks such as claystones and sandstones. On the drier areas natural vegetation consists of forest (mainly puriri and totara), on the wetter areas of kahikatea and cabbage trees, and on low-lying swampy areas of flax and raupo.

Meadow or gley soils of the larger alluvial areas occur mainly to the south of Kaipara Harbour, in Northern Wairoa and Waipu, and near Awanui. These older alluvial soils have developed on low-lying flats with the water-table at or close to the surface. Natural vegetation ranges from tall manuka, kahikatea forest, and cabbage trees on the drier areas to the flax, raupo, and rushes of the swamps.

Terrace alluviums: Some are formed from clays and gumland silts. The drier terraces originally carried kauri and some totara and the wetter, less well-drained areas low scrub and wiwi rush. Other terraces, consisting principally of volcanic material but with proportions of clay and sand, carried tall manuka and in places some taraire, totara, and occasional kauri on the drier soils, and on other soils scrub and wiwi rushes.

Peaty soils occurring throughout the north in wet, low-lying areas are mainly built up from peat accumulations, which in some instances are mixed with sands. Most peat swamps contain considerable timber and are covered with sedges and rushes.

Tidal flats, some of which have been reclaimed, are clays, sands, or admixtures of both, and some contain quantities of shell. Natural vegetation consists of marine rushes and mangroves.

Recommendations

Almost all these soils in grass are used for dairy farming and to a smaller extent for the fattening of cattle. Though on a few areas fat lambs are produced, in general their low-lying, heavy nature and wet condition for part of the year make them less suitable for grazing sheep.

The responses obtained on the recent alluvial soil are not as great as those on the other types, because this soil has a higher natural fertility.

The meadow soils respond well to lime in addition to phosphates, and the greatest responses are obtained from serpentine superphosphate plus lime or basic slag plus lime. Basic slag without lime gives a good response but less than that of either superphosphate or serpentine superphosphate plus lime.

The terrace alluvials are much more lime responsive and some also respond to the addition of potash to lime and phosphates. The peats also show a response to potash. Therefore good topdressing practice will require applications of lime at 1 ton per acre initially and 5cwt. annually, together with 3cwt. of phosphate applied early each autumn, and on the peats and some of the terrace alluviums 1cwt. of muriate of potash per acre.

Limestone Country

The larger areas of soils overlying limestone occur in Rodney, Otamatea, Hobson, and Bay of Islands Counties, with smaller areas in Hokianga, Mangonui, and Whangarei Counties. Typical natural vegetation consists of puriri, taraire, cabbage trees, and nikau palms. Where complexes are formed with yellow-brown earths totara and kauri were mixed with the other vegetation on the shallow limestone soils.

Recommendations

Most of the easy and undulating limestone country in grass in Northland is used for dairy farming and fat-lamb raising. It might be thought that limestone soils would not require lime applications, but lime is so readily leached down from the topsoil, particularly in the high-rainfall areas, that responses to lime are general on these soils. Responses indicate that suitable topdressing practice will involve initial applications of 1 ton of lime per acre, followed by 4cwt. per acre yearly or 1 ton every 3 or 4 years, together with 3cwt. of superphosphate or basic slag early each autumn.

Steeper limestone pastures used for sheep and cattle grazing require applications of basic slag or North African phosphate every 2 or 3 years.

SUMMARY OF RESPONSES TO TOPDRESSING ON LIMESTONE SOILS

(0, no response; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent.)

SOIL TYPES	UNLIMED					LIMED				
	Superphosphate	Serpentine superphosphate	Basic slag	North African phosphate	Superphosphate plus potash	Superphosphate	Serpentine superphosphate	Basic slag	North African phosphate	Superphosphate plus potash
Arapohue clay	3	2½		2		4½	3½		1	
Arapohue clay (deep phase)	3				3	4				4
Matakohe clay complex	3		3½	2½	3	4½		4½	3	4½

TOPDRESSING PASTURES IN NORTHLAND . . .

Undulating and Hill Soils—Ib, Ic, Id (not volcanic or limestone)

Occurring throughout and forming in aggregate the greater proportion of the North Auckland peninsula are soils derived from consolidated sand (mainly along the west coast and in the far north) and the sedimentary rocks—sandstones, claystones, mudstones, and shales. These soils mature through leaching, which in this series is affected chiefly by the past vegetative cover and to a less extent by rainfall and topography, and ultimately form podzols (a Russian word referring to the ashy-grey colour of the subsoil).

Yellow-brown earths comprise the less leached, young, immature, and early semi-mature soils with brownish-yellow subsoils. Those from sands were originally covered by sand grasses and short scrub, and the natural vegetation on soils from the sedimentary rocks ranged from taraire, puriri, and karaka to totara, rimu, kahikatea, and kauri.

Weakly to moderately podzolised yellow-brown earths include the more leached semi-mature to early sub-mature types with dull, greyish-yellow subsoils. Their texture in general is heavy, and some are known as the clay gumlands. The former cover was mainly kauri and totara, with both tall and short scrub on the more leached types.

Podzols, both sub-mature and mature, result when soils are leached strongly and a grey layer develops about 6 to 12in. below the surface. Rain-water becomes acid in the top-soil and passes down, taking with it iron and other compounds from the upper part of the subsoil, which becomes grey. In some soils dark substances, mostly from organic matter, are deposited immediately below, while the iron passes further down and in mature podzols forms a pan. Known as sandy gumlands and pipe-clay gumlands, country carrying these soils is characterised by poor, impeded drainage. The natural vegetative cover consists of low scrub and wiwi rush.

Soils of mixed origin, from both sedimentary and volcanic rocks, also occur in the undulating and hill country.

SUMMARY OF RESPONSES TO TOPDRESSING ON UNDULATING AND HILL LAND IN NORTHLAND

(non-volcanic and non-limestone)

(O, no response; ?, doubtful; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent)

SOIL TYPES	LOCAL OR COMMON NAME	UNLIMED							LIMED						
		Superphosphate	Serpentine superphosphate	Basic slag	Heskett slag	North African phosphate	Superphosphate + potash	Slag + potash	Superphosphate	Serpentine superphosphate	Basic slag	Heskett slag	North African phosphate	Superphosphate + potash	Slag + potash
YELLOW-BROWN EARTHS—															
Red Hill sand ..	Consolidated sand	3½	2½			1½	3½		4	3			1	4	
Red Hill sand (complex)	Consolidated sand	3½		2½		½	3½	2½	4		2½		½	4	2½
Red Hill sandy loam	Consolidated sand	3		2½		3	2½		3		2½		1½	3	
Omania clay loam	Clay	3		4											
Waiotira light clay	Clay		2							4					
Marua clay loam ..	Clay	½	1	2	?	1	½		3	3	4	1	3	3	
Marua brown clay loam	Clay	½	1	2	?	1			2½	2			2		
WEAKLY AND MODERATELY PODZOLISED YELLOW BROWN EARTHS—															
Rockvale clay ..	Heavy clay	1		2			1	2	3		3			3	3
Okaka silty loam .	Silty clay	1½		3		3									
Waikare clay ..	Gumland clay	1½		2½		1½	2	2½	3		3½		2½	3½	3½
Whangaripo clay loam	Clay	1	1			1½			2	2			2		
Warkworth clay ..	Clay	1	1	1½	1	2	1½		3	3	3	1½	3½	3½	
Waikare clay and sandy clay ..	Gumland clay	2	2	2		2	2	2½	3	3	2½		2½	3	3
SUB-MATURE TO MATURE PODZOLS—															
Hukerenui silt loam	Pipe-clay gumland	1	1			1			3	3			2		
Hukerenui sandy loam	Pipe-clay gumland	1					1		4					4	
Te Kopuru sand ..	Sandy gumland	1	1½	2½	½	2	2	3½	3	3½	4	1	1½	4½	5
Wharekohe silt loam	Pipe-clay gumland	2		3		1	2	3	3½		4			4	4½
Wharekohe fine sandy loam ..	Pipe-clay gumland	1½		2		3½	2	2	4		3		1	4	3
Wharekohe sandy loam	Pipe-clay gumland	1½		2½		1½	1½	2½	3½		4		2½	4	4½
COMPLEX SOILS—															
Otao fine sandy loam	Loam and sandy loam	1		2½	1	1	2½		2		3½	2	2	4	
Waitemata clay to fine sandy loam .	Clays and loams	1		2½	½				3½		4	2			
Kaimairo brown and yellow clays ..	Clay and semi-volcanic		½							1					
Hihi grey clay and gravelly loam ..	Clay and ironstone	1½	2			1½			4	4			3		

TOPDRESSING PASTURES IN NORTHLAND

Undulating pasture land in the Northern Wairoa district.

Recommendations

Soils on the easy and undulating areas of Northland which are topdressed are used mostly for dairy farming and fat-lamb raising. Pastures on gumland soil types are almost all used for dairy farming.

The yellow-brown earths may be divided into two general classes according to their responses: Soils such as the Red Hill sand and related loams on which good to very good responses are obtained from superphosphate, lime giving only very slight additional responses; and clay soils on which responses from superphosphate are only slight but the addition of lime results in good responses. On the first types annual dressings of 3 to 4cwt. of superphosphate per acre will be suitable, though information available indicates that on the longer-established pastures occasional applications of lime will prove profitable. On the other types heavy initial applications of from 10cwt. to 2 tons of lime per acre followed by 5cwt. annually are indicated, with superphosphate at 3cwt. per acre.

On the weakly and moderately podzolised yellow-brown earths responses indicate the necessity for adequate liming plus superphosphate, serpentine superphosphate, or basic slag, with applications of potash on some soil types.

On sub-mature to mature podzols lime plus basic slag plus potash produces the higher responses. Basic slag alone does not give quite as good responses as superphosphate plus lime, but this combination gives less response than basic slag plus lime. On podzolised soils good topdressing practice necessitates initial heavy applications of lime—from 10cwt. to 2 tons per acre according to the soil—followed by annual dressings of 4 or 5cwt. of lime; 1cwt. of muriate of potash per acre annually should prove worth while on some soil types. On areas where liming is precluded 3cwt. of basic slag per acre annually is indicated.

Soils on the moderately steep and steep areas almost all consist of the yellow-brown earths and, to a smaller extent, the weakly to moderately podzolised yellow-brown earths. These hill soils which carry grass are used for sheep and cattle grazing. In most areas the use of lime is costly and annual dressings of phosphates are not feasible. Consequently slower-acting phosphates with more lasting effects are necessary. Applications of basic slag or North African phosphate at 4cwt. per acre at intervals of up to 4 years will increase pasture production.

Growth of Fertiliser Usage

Though in earlier years some fertilisers had been applied to grassland in Northland, not until toward the late 1920's did topdressing become at all general. Improved and additional road and rail transport augmenting the coastal shipping services brought about a greatly increased usage of fertiliser. The topdressing of pasture with phosphatic fertilisers and lime has been one of the major, if not the major, factors in developing Northland farming. During the past two decades dairy production has more than doubled and other farm production has increased by about three-quarters.

In this high-rainfall area with considerable leaching of soils and a high incidence of phosphatic fixation it was found early that applications of superphosphate alone were not very effective unless ground limestone was also applied. As limeworks had not been developed to any extent, much of the topdressing was done with basic slag and ground rock phosphates. The proportions of each used varied with both price and the supplies available from overseas.

From 1925 to 1930 the quantity of fertilisers applied to grassland increased steadily, but during the difficult years of the early 1930's both the quantity used and the area topdressed decreased. With low returns for his produce, the farmer tended to include topdressing costs among the first farm expenses to be reduced. Imported phosphates became less freely available because of supply and price, and an increase in the use of superphosphate resulted. From the 1934-35 season onward a steady increase was resumed, usage reaching a peak in 1940-41, when 411,695 acres were topdressed with phosphatic fertiliser. In those 7 years the area topdressed doubled. Wartime fertiliser rationing curtailed topdressing, but by 1947-48 the 1940-41 position had been regained.

Perhaps one of the most striking features of topdressing in Northland has been the remarkable increase in the use of lime. Details of lime usage before 1932-33 are not available, but from that season until 1946-47 the area topdressed with lime increased five and a third times.

In the late 1930's imported fertilisers, as well as being in short supply, were more costly to apply than dressings of superphosphate and lime. During the war increased areas were limed, in the

Types of Phosphates Used for Topdressing in the Eight Northern Counties, 1926-27 to 1929-30

YEAR	SUPERPHOSPHATE		BASIC SLAG		*OTHER	
	Acreage	Per cent.	Acreage	Per cent.	Acreage	Per cent.
1926-27	42,825	55	22,304	29	12,319	16
1927-28	75,915	62	35,045	29	11,316	9
1928-29	72,419	40	90,275	50	18,520	10
1929-30	79,864	47	111,119	33	44,522	20

* Mainly ground rock phosphates.

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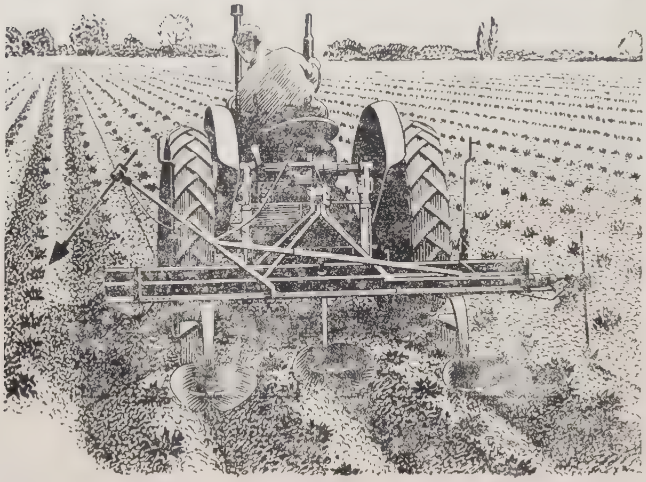

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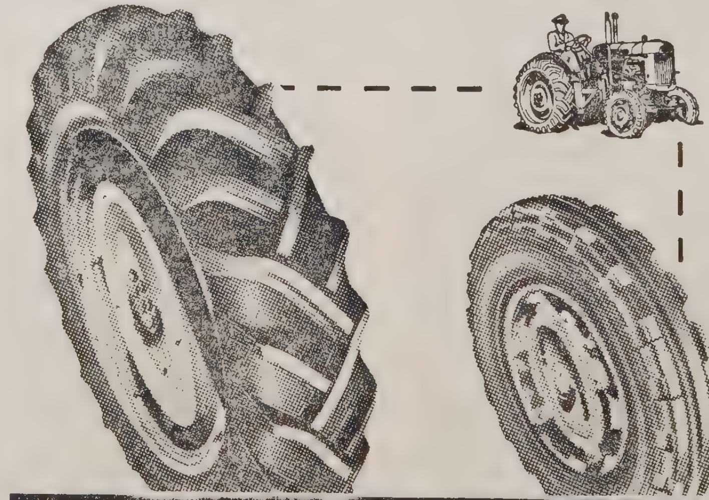

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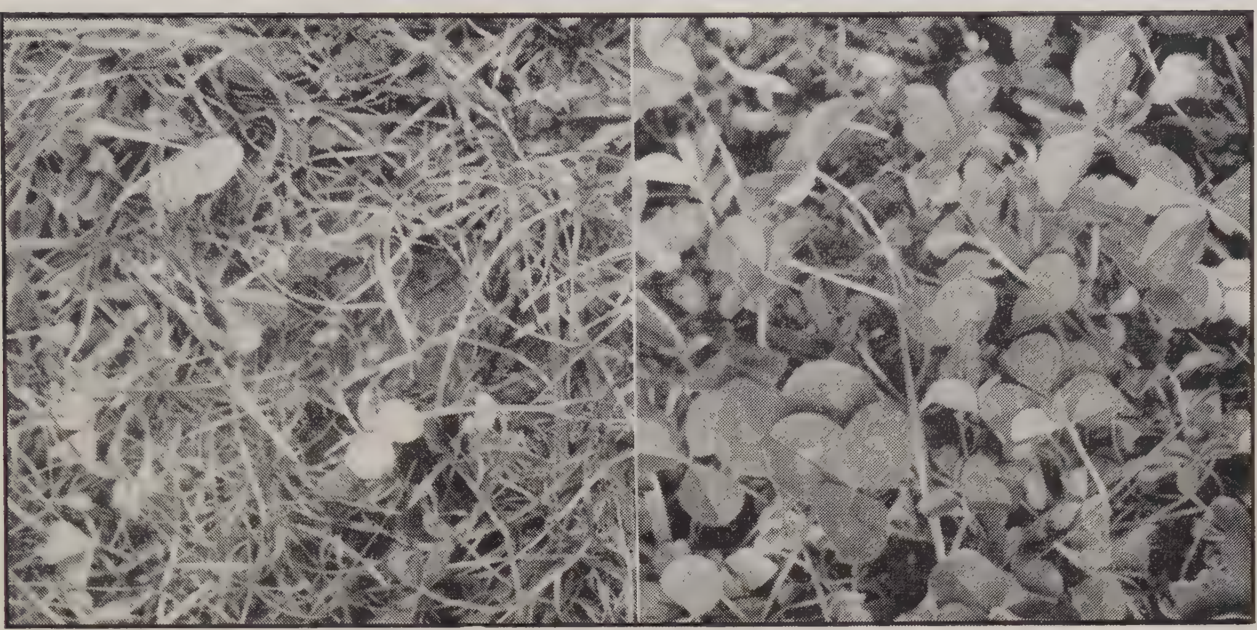


Responses to topdressing on Rockvale clay with superphosphate (left) and with superphosphate and lime (right).

early period as a complement to increased use of fertilisers and later to attempt to overcome shortage of phosphatic fertilisers and to make full use of superphosphate on the lime-deficient soils with a high phosphate-fixation capacity. During those years no imported basic slag and ground rock phosphates were available. In 1943-44, when phosphatic fertiliser supplies were lowest, 63 per cent. of the total area topdressed received lime. The value of adequate liming has been realised and the amount of lime used continues to increase. In 1929-30 less than 3500 tons was applied to 13,015 acres, in 1936-37 slightly less than 15,000 tons to 98,360 acres, in 1939-40 about 40,000 tons to 151,457 acres, and in 1946-47 109,000 tons to 230,496 acres. Though since 1945-46 the area limed as a percentage of the total area topdressed has decreased slightly, the amount used is still increasing, 112,000 tons being used north of Auckland during 1948.

In 1946-47 (the latest season for which details are available) 354,264 acres out of a total of 1,318,949 acres in grass were topdressed with phosphates or phosphates and lime. In addition 43,858 acres received applications of lime only. The area topdressed with phosphatic fertilisers is only 12½ per cent. of the total grassland. It can be considered fairly certain that more than 90 per cent. of the fertiliser is applied to pastures on the flat and undulating country. In each of the 1947-48 and 1948-49 seasons some 52,000 tons of phosphatic fertilisers was used on about 450,000 acres.

Likely Trends in Future

Ample scope exists for increased use of fertilisers and lime in Northland, and expansion of topdressing in the area will come about as a result of several practices.

First is the more intensive use of fertilisers and lime on areas now topdressed. Adequate and regular topdressing will improve the sward and raise the production from many existing pastures. The ploughing up of existing topdressed but poor pastures and their sowing down in superior strains of grasses and clovers will necessitate increased use of fertilisers and lime to make the work worth while.

The second practice will be the application of fertilisers and lime to pastures not now topdressed. On ploughable country this will involve mostly ploughing up and resowing into high-producing pastures, which will require adequate applications for both establishment and maintenance of good swards. On hill country, where at present only small areas of sheep- and cattle-grazing areas are topdressed, expansion must be accompanied by improved farm roading and the introduction of clovers into the hill-pasture swards.

Third, the development of scrubland into pastures will require adequate fertiliser and lime. It is estimated that during the next 10 years an average of 15,000 acres of virgin or deteriorated scrubland will be grassed annually.

The costs involved in renewing or improving existing pastures and bringing in new areas on easy and rolling country to high-producing swards will mean that economically these areas will best be used for dairy farming and fat-lamb raising. Here expansion of topdressing will require greater use of lime and fertilisers such as superphosphate, serpentine superphosphate, basic slag, and on some soils potash.

Only on a few areas where the cost of liming is high will the use of North African phosphate be justified. The expansion of topdressing on hill country where the soils are very responsive to lime but where it cannot be applied economically will require increased quantities of North African phosphates and to a smaller extent basic slag.

Young, fertile, consolidated-sand country on the west coast of Northland.

Improved Methods of Queen Rearing

By L. H. JOHNSON, Apiary Instructor, Department of Agriculture,
Palmerston North.

IT is not claimed that there are today any entirely new methods of queen rearing, as each idea is usually an extension of some previously developed system. Many ways of raising queens have been used successfully by individual beekeepers, but because of the many hive manipulations required, they have not been adopted widely. The two main points upon which the working system is built are: First, the design of a double floorboard; secondly, the use of special holders for queen cells.

THE first method of queen rearing is in some respects similar to that devised by E. J. Hand for honey production, by which the flying bees could be drafted into the adjoining hive simply by moving a lever. The second method is a means of obtaining queen cells built into holders which can be fixed to the side of a comb, similar to the Greig method.

The first move in this queen-rearing operation is to select a comb which has been used for one or two hatches of brood the previous season. This will slightly toughen it. Neither an old brood comb nor a delicate new one is suitable. Place the comb in the centre of the brood nest of the breeder queen, feed the colony, and leave it for 7 days. At the end of this period there should be an abundance of larvae the right age for transferring as will be explained later.

Making the Floorboards

It will be seen from the diagrams on this page that the floorboard is a little more than double normal width so that it will support two supers side by side and 3in. apart. Three entrances are provided, two at the front and one at the rear. To each entrance fit a small strip of galvanised iron to be used as a slide to open or close the opening as required.

First Manipulation: Preparation of Colony

Begin operations 2 days after placing the comb in the second hive with the breeding queen. Select a very strong, two-storied, queen-right hive containing approximately 14 combs of brood and a strong force of bees.

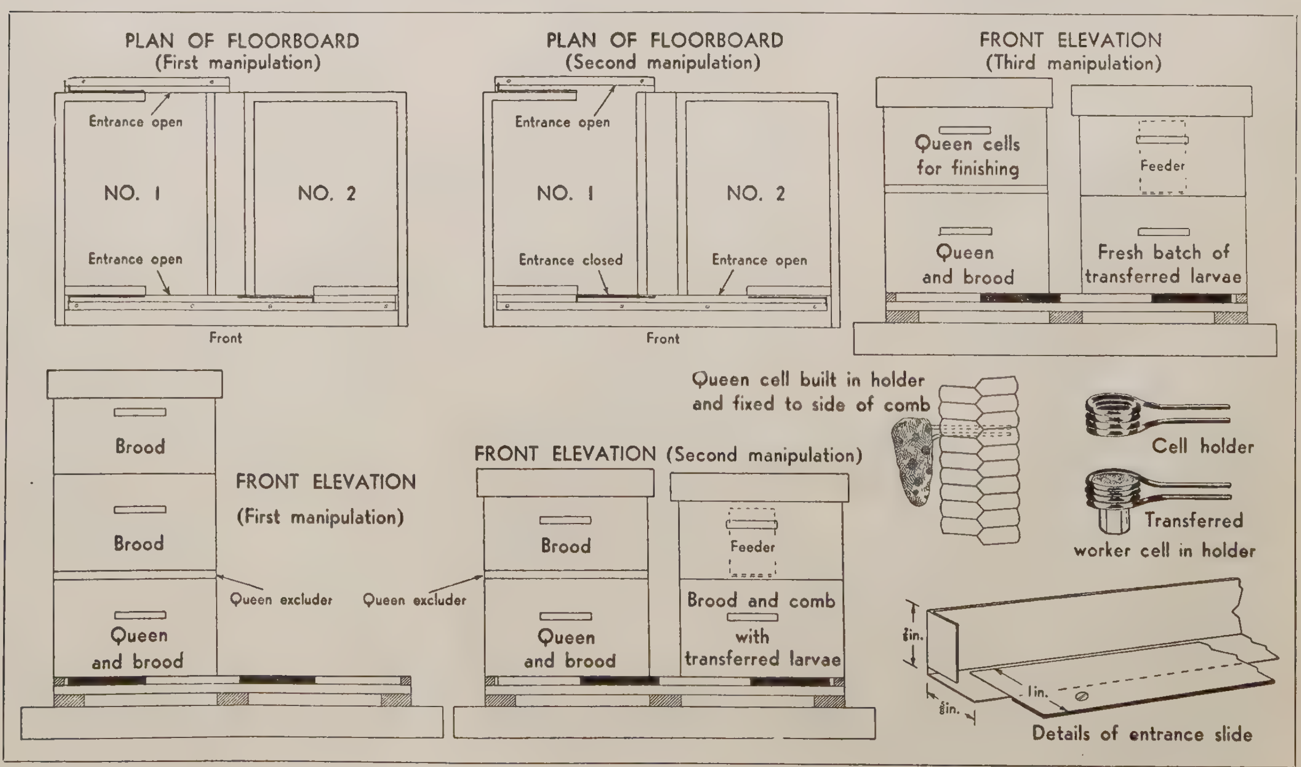
Replace the single floorboard with the double unit and place the colony on the left-hand side referred to as No. 1. The front entrance to this unit should be open and in the same position as formerly. The hive should now be adjusted by shaking the bees off the combs in the top super into the lower brood box. This is to ensure that the queen is below. Place a queen excluder on the lower brood box and replace the super containing the remainder of the brood on top. To strengthen the hive further in bees add another super containing 7 frames of brood and adhering bees, which may be collected from several of the stronger colonies in the apiary. When taking brood combs from these strong hives give each frame a light shake, which will dislodge most of the flying bees but will at the same time retain the young bees on the combs. See that the feeder is well supplied; then close the hive and leave it for 5 days so that the feeding of the larvae may be completed. The end of the first manipulation should be as shown; that is, two supers of brood above a queen excluder, and below a brood chamber with a laying queen. Open the rear entrance to No. 1 hive so that some of the flying bees will begin to use it.

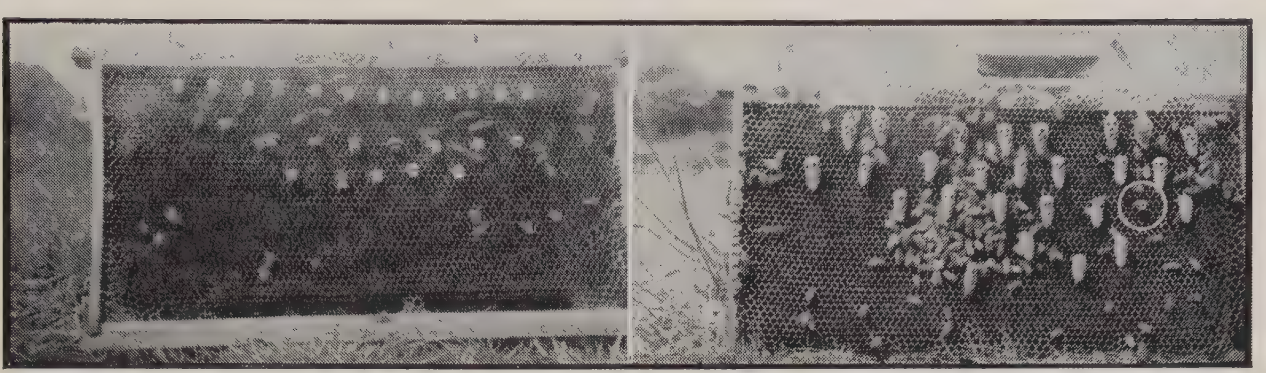
Second Manipulation

In 5 days resume operations in the forenoon. Lift off the top super and bees and place on the No. 2 section, which will now be the queen-rearing unit. Examine the brood and destroy any queen cells. Examine each brood comb in the super above the queen excluder and destroy any queen cells; no more can then be raised from the brood dealt with.

Close the front entrance to No. 1 unit, thus drafting all the flying bees into the No. 2. The queen-rearing hive will now be well stocked with nurse bees and fielders.

An abundance of pollen gatherers appears to be as necessary as nurse bees.


PLAN OF FLOORBOARD
(First manipulation)
Entrance open
NO. 1
NO. 2
Entrance open
Front
PLAN OF FLOORBOARD
(Second manipulation)
Entrance open
NO. 1
NO. 2
Entrance closed
Entrance open
Front
FRONT ELEVATION
(Third manipulation)
Queen cells for finishing
Feeder
Queen and brood
Fresh batch of transferred larvae
Brood
Brood
FRONT ELEVATION
(First manipulation)
Queen excluder
Queen and brood
Queen cell built in holder and fixed to side of comb
FRONT ELEVATION (Second manipulation)
Queen excluder
Brood
Feeder
Queen and brood
Brood and comb with transferred larvae
Cell holder
Transferred worker cell in holder
⅜in.
1in.
⅜in.
Details of entrance slide



Left—Transferred cells after 24 hours. Right—A fine batch of finished queen cells in the holders; queen cells hang free from the comb. Double this number may be attached to a comb. Note that one cell (in circle) has not been developed by the bees.

A comb should be removed to provide a space in the centre of No. 2 hive to receive a batch of grafts. Next fill up a feeder so that the bees may start work on it before the cells are put in.

Transferring Cells with Larvae

Larvae for queen cells are not grafted into artificial wax cups, but the cells containing the larvae with bee milk are cut out of the comb. A suitable instrument to do this can be made from a small metal cylinder about 3in. long and of a size that will fit neatly over an ordinary round lead pencil, which is approximately 5/16in. in diameter. The end of the cylinder should then be slightly belled out and sharpened. The cell of a newly hatched larva is selected and cut out by pushing the cylinder over it and giving it a slight circular motion. The cylinder is pushed through the comb and then withdrawn with the cell inside.

Coiled-wire Cell Holders

A coiled-wire cell holder is an innovation which makes possible the fixing of the worker cell to the side of a comb, thereby overcoming the main problem previously met with. This small device may be made by winding a piece of wire four times around a nail punch held in a vice and leaving the two ends projecting approximately 1in. The wire should be about as thick as the lead used in a propelling pencil. A single strand unwound from a wire clothes line is very suitable.

The cell may be taken from the end of the cylinder with the fingers and pushed through the cell holder until it is in the right position. Should the cell stick in the cylinder it can be pushed out with a loose-fitting push stick. The cut-out cell should fit so that it does not fall through the holder. The bees will then refashion the cell to a full-size queen cell.

Comb Support for Queen Cells

Select a dry extracting comb and push the two points of the cell holder through the midrib with the open cell pointing downward. About 50 cells may be attached to one side of this comb and then it can be inserted in the space left in the queen-rearing hive referred to as No. 2. The dry comb placed in the middle of a crowded hive becomes a centre of activity, the bees cleaning up the cells and bringing in fresh honey adjacent to where the nurse bees are working on the queen cells. The transferred queen cells on the comb are much more accessible and give a better foothold to the masses of bees than is the case where cell bars are used. This completes the second manipulation.

Third Manipulation

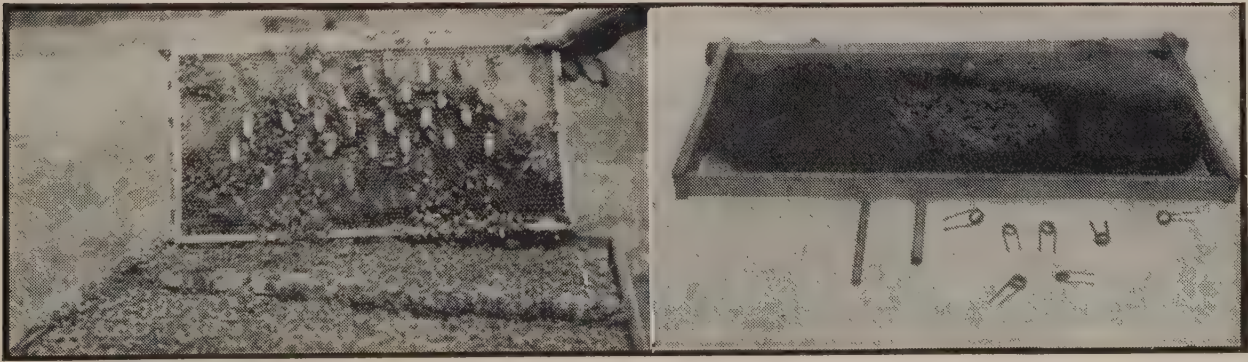
In 4 days the comb with the queen cells may be transferred to the centre of the super above the queen excluder in No. 1. A fresh batch of transferred worker cells may now be given to No. 2. This completes the third manipulation.

Finished Queen Cells

The queen cells should be given to nuclei not later than 10 days from the date of the transference of larvae. With the holder it is easy to remove a queen cell and fix it to the side of a comb in a nucleus hive by pushing the projecting points through the midrib. Neither comb is damaged by the queen cell holder.

A batch of queen cells may be raised each week in the one hive if the following method is adopted.

At intervals brood combs should be taken from the brood nest and placed above the excluder. They should be replaced by empty combs to keep the queen working to capacity. After 4 days the brood combs should have any queen cells on them destroyed, and after removing combs where bees have hatched in No. 2 replace them with the brood combs to maintain the stock of young bees. Before the honey flow starts a queen cell may be left in No. 2 and the hive moved to a new stand for increase. If this is not required, a queen cell may be left in No. 2 and later the old queen destroyed and the colony united with the new hive and supered for the honey flow.



Left—Another batch of 30 queen cells and a hive full of bees, showing space for a frame. Feeding was not continuous; hence the irregular-sized cells. Right—Push stick, cylinder cell cutter, and wire cell holders.

IMPROVED METHODS OF QUEEN REARING . . .

To avoid any possible confusion in the timing of the various manipulations a brief summary is given as follows:—

Breeder hive: First day, Monday, 4th: Insert comb.

First manipulation: Wednesday, 6th: Adjust No. 1.

Breeder hive: Friday, 8th: Insert second comb.

Second manipulation: Saturday, 9th: Remove comb from breeder. Establish No. 2 and set cells.

Third manipulation: Wednesday, 13th: Move cells to over excluder. Set new batch.

Ripe queen cells: Monday, 18th: Transfer to nuclei.

This method of transferring cells instead of larvae may be a help to older men who find that the hand is not so steady nor the eyesight as good as formerly but who still have to do queen rearing. It simulates natural conditions more closely than does grafting and is much less work. The queen cells so built are first class.

Grafted Cells

For those who prefer grafting, the cell holder will be found very useful as a holder for the artificial wax cup. It will usually be found that more larvae are accepted by using a comb as a cell support than is the case when wooden bars are used. This may be because the bees on the comb start feeding the larvae with a minimum of delay, and this is important. The drying up of the grafted larvae is the greatest cause of losses. The finished queen cells cannot be distinguished from those done by the method described earlier.

At no time should there be a let-up in feedings, or results may be disappointing. Even if there is ample honey in the combs, it appears that steady income of honey is vital for the production of full-sized queen cells.

Should the feeder be left empty for a day, cells may be torn down or be finished undersize. All hives from the breeding queen to the nucleus should be continuously and liberally fed. Sugar syrup may be used, but a mixture of equal proportions of honey and water is preferable, though it must not be left to ferment. Another method which has been used successfully is to place an empty super above the mat on No. 2 hive and put in 4 combs of manuka honey. Space the combs well apart and "bleed" them by scraping some of the capping off with a hive tool. The bees, which should be allowed access to this super through the mat, will take the honey below for feed as required. Excellent queen cells have been built by this method of feeding. Another point which should not be overlooked is the importance of pollen. If spring conditions do not permit the field bees to gather adequate supplies, it may be profitable to feed a pollen supplement to the No. 1 and No. 2 hives.

By making a careful study of the main points and putting them into practice a comparatively inexperienced beekeeper may breed any number of good queens for his own requirements.

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SOUR SAP OF FRUIT TREES

SOUR sap, a physiological trouble occurring in orchards (commercial and domestic) throughout New Zealand, causes the loss of many fruit trees each year. In this article by H. A. Prew, Orchard Instructor, Department of Agriculture, Auckland, information is given which will assist orchardists to recognise the symptoms of sour sap and enable them to apply preventive treatment before it is too late.

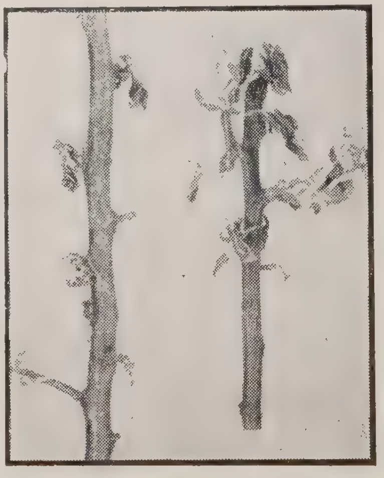
SOUR sap is associated with poor soil drainage or "wet feet". As fruit trees will not stand excessively wet conditions for more than very short periods, it is essential that the soil should remain reasonably well drained for tree roots to stay in good condition. Quite often during wet winters, unless the drainage is good, the roots of trees are drowned. Food stored in the limbs may be sufficient to start the trees into growth early in spring, but the trees soon require nutrients from the soil and must depend on their roots for sustenance. If the roots have been injured by very wet soil conditions, it is quite obvious that they will be unable to fulfil their function, and the trees must suffer.

Sour sap may kill the roots before spring growth starts, but very often the buds burst and the leaves appear, though as is shown in the illustration they do not develop to normal size. On stone fruit trees the leaves go brown and on pip fruit they usually develop a greyish tinge. All affected trees have a stocky appearance. The bark rots around the base of the trunk and on the roots just under the surface of the ground, and bark on some limbs and tips of branches lifts and breaks away.

If the wood of affected trees is cut, there is usually a characteristic sour smell, hence the name sour sap.

Effective soil drainage is the only remedy for sour sap, as it will protect unaffected trees and will allow any trees not too seriously affected to recover. Excess soil water must be permitted to drain away freely, the methods to be adopted to achieve this varying with circumstances. Covered drains of field tiles, scoria, or even bundles of manuka are useful, and open drains may be used if convenient.

Slopes do not always drain well, especially if the soil is a heavy clay type. If the trees look sick, are not making normal growth, or have dieback or patches of rotten bark, poor drainage should be suspected, and if it appears to be the cause of the trouble, work should be done to improve it.



A typical sour sap condition.

In wet situations it is far better to provide suitable drainage before planting the trees than to try to save trees from the effects of poor drainage after they have shown signs of deterioration.

Because the root systems of trees affected by sour sap are considerably reduced, it is often necessary to water the trees frequently in the following summer so that during dry weather the few remaining sound roots will be able to keep the trees supplied with sufficient moisture.

☆

SHOW DATES

THE following are dates and venues of A. and P. shows up to April 7.

†March 2 and 3—Buller A. and P. at Westport.

March 3—Waiotira Junction A. and P. at Waiotira.

March 3—Amuri A. and P. at Rotherham.

March 3—Albany A. and P. at Albany.

March 3—Matamata A. and P. at Matamata.

March 3—Temuka and Geraldine A. and P. at Winchester.

March 3—Maniatoto A. and P. at Ranfurly.

March 3—Whakatane and Rangitaiki A. and P. at Whakatane.

March 7—Morrinsville A. and P. at Morrinsville.

March 10—Hawkes Bay A. and P. (autumn show) at Hastings.

March 10—Kumeu District A. and H. at Kumeu.

March 10—Mt. Benger A. and P. at Roxburgh.

March 10—Mayfield A. and P. at Mayfield.

March 13—Lake County A. and P. at Arrowtown.

March 15 and 16—Christchurch Flock Ram Fair at Christchurch.

*March 17—Methven A. and P. at Methven.

†March 17—Cheviot A. and P. at Cheviot.

March 17—Wellsford A. and P. at Wellsford.

*March 26—Mackenzie County A. and P. at Fairlie.

March 26—Strath Taieri A. and P. (jubilee show) at Middlemarch.

*March 31—Hawarden A. and P. at Hawarden.

April 7—Oxford A. and P. at Oxford.

* The Department of Agriculture exhibit will be staged at this show.

† The dates of these shows have been changed from February 23 and 24 and March 10 respectively.

◆

Development of a Hawkes Bay Fat-lamb Farm

By F. H. COLLIN, Fields Instructor, Department of Agriculture, Hastings.

A LARGE proportion of the rolling country surrounding the Heretaunga Plains, although not fully developed, has shown vast improvement in production over the past 20 years. This has been achieved on the ploughable country by cropping and resowing to English pasture, and on the steeper country poor pastures have been improved by topdressing and oversowing with clovers. As a result, in less than 20 years, properties which previously carried only one ewe to the acre today, after subdivision, are carrying three to four ewes to the acre and fattening all lambs. This article deals with the methods and achievements of one farmer on the type of country referred to and details his work of subdivision, topdressing, cropping, drainage, tree planting, etc., which have enabled him to farm the area as a first-class lamb-fattening property.

THE farm is owned by Mr. R. P. Hanrahan, who acquired the property in 1933. It is situated, as illustrated on the soil map on the next page, 12 miles south of Hastings on the Middle Road in the Te Mahanga district and approximately 15 miles from the coast. The total area is 334 acres, of which 200 are flat and rolling country and the remainder steep, unploughable hills.

The original area was divided into 3 paddocks which separated the flat and rolling country from the hills. The flat was ploughed in 1900 and sown in English grasses, but owing to the management, type of soil, and inadequate drainage, the results achieved by ploughing, cultivation, and resowing eventually were lost. Rushes were prominent on the flats and had also spread to the rolling country, which was predominantly danthonia and browntop. The water for stock was supplied by natural springs on the hills; these springs were uncontrolled and the water slowly flowed down open watercourses on to the flats. Stock had access to the streams which were virtually bog holes on the flats and become a harbour for liver fluke snails.

Mr. Hanrahan realised that an extensive programme involving subdivision, shelter belts, drainage, topdressing, and the introduction of higher-producing grasses and clovers would be necessary to ensure successful fat-lamb farming.

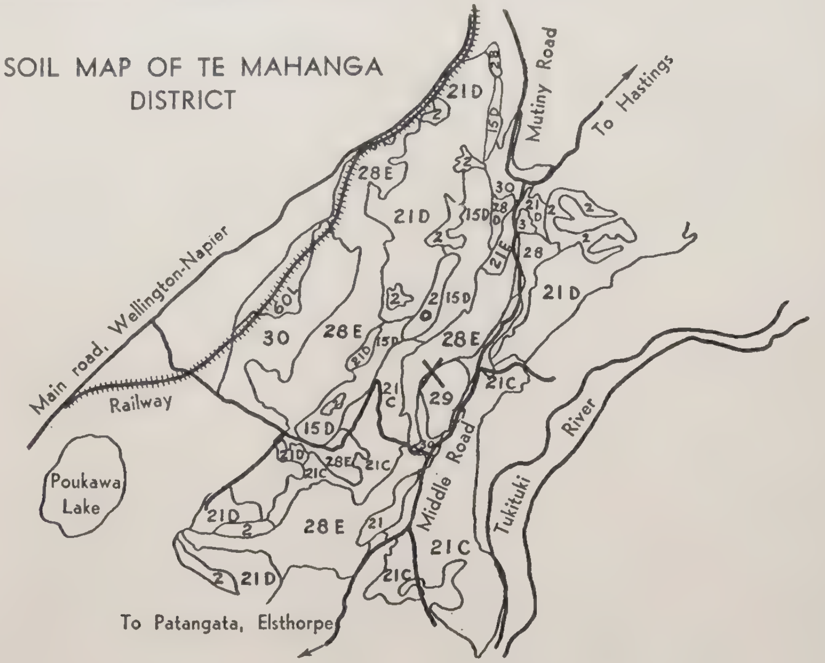
Climate

The distribution of rainfall throughout Hawkes Bay is variable and there are several distinct rainfall belts. The average yearly rainfall in the district referred to is approximately 35in. and, as there are only mild frosts and no extremes of heat and cold, greenfeed crops can be grown with considerable success. The area is subject to dry conditions during the summer, but the majority of fat lambs from the Heretaunga Plains and the surrounding district are disposed of to the freezing works before pastures are adversely affected.

Soil Types

The farm lies in a fairly warm valley most of which faces the east. It is well sheltered by surrounding hills, except for the southern boundary, which is exposed to occasional cold winds.

The hill country at the back of the property, which rises to a height of 1300ft., consists of 134 acres, which contain 3 soil types: Te Mata sandy loam (2), Tangoio sandy loam (15D), and Crownthorpe silt and sandy loam series (21C). The soils of the steep and moderately steep country are formed on muddy sandstones containing beds or bands of limestones, from which springs emerge. The water supply to the farm and homestead is obtained from these springs.



SOIL MAP OF TE MAHANGA DISTRICT

LEGEND

No.		Classification
2	.. ..	Te Mata sandy loam—steep
15D	.. ..	Tangoio sandy loam—steep
21	.. ..	Crownthorpe sandy loam—moderately steep
21 C and D	..	Crownthorpe series—more fertile phase
28	.. ..	Matapiro sandy loam—rolling
28D	.. ..	Matapiro sandy loam series—more fertile
28E	.. ..	Matapiro light silt loam—rolling
29	.. ..	Okawa heavy sandy loam—flat terrace
30	.. ..	Waipukurau sandy loam—flat terrace
60L	.. ..	Hastings loam
o		Trig station, 1314ft.
X	.. ..	Location of farm

Soil type 28E (Matapiro light silt loam) is fairly uniform over the rolling country, and the soil of the greater part of the farm is of this type. Matapiro light silt loam is somewhat more fertile and heavier than the sandy loam series and contains outcrops of limestone. In very wet weather drainage is rather slow and water is inclined to lie in depressions.

The flat country, about 80 acres, is mostly soil type 29, Okawa heavy sandy loam, a small portion being Waipukurau sandy loam (soil type 30). Both series are of good natural fertility, with 18in. and more of heavy loam on a greyish-yellow clay pan. Drainage is required on this type of soil or poaching occurs in wet seasons, but even with sufficient drainage paddocks are inclined to pug in a very wet winter. Both flat and rolling country respond well to applications of superphosphate, and lime is used on the flat country, with good results. Greenfeed crops, lucerne, perennial ryegrass, and white clover grow exceedingly well if well managed and given adequate supplies of fertilisers.

Since the present owner acquired the land 15 years ago the 200 acres of flat and rolling country have been subdivided into 14 paddocks, varying in size from 12 to 27 acres. The remaining 134 acres of steep hill has yet to be fully developed. All the flat and rolling paddocks have been ploughed and sown down in permanent pasture with perennial ryegrass and white clover. Before ploughing was done the larger rushes were grubbed. The remainder were well turned under at the time of ploughing and before cultivation began. This work has been carried out gradually and now, after about 15 years, a systematic method of greenfeed cropping and grazing has been evolved. As mole drainage was not practicable on account of the texture of the subsoil, a series of small open drains with a good flow of water has been operating efficiently. Concrete troughs have been erected and water is piped from a main spring on the hill to all paddocks. This spring also supplies the sheep dip and the owner's residence.

Shelter belts which have been planted are mainly *Pinus radiata* backed with macrocarpa. In recent years two small shelter belts of macrocarpa and lawsoniana have been grown. A small, well-fenced area near the woolshed has been provided to grow seedlings, which when large enough are planted out into shelter belts in the autumn.

Greenfeed and Topdressing

Each year one paddock of between 15 and 20 acres is ploughed in the autumn and sown down in greenfeed barley. The land is ploughed in early March, cultivated, and sown about March 22. The seed is cross-drilled at the rate of 3 bushels per acre with 1½cwt. of superphosphate. The area is grazed off several times with ewes throughout the winter and in the spring is reploughed and sown in chou moellier. Ploughing begins the last week in September, the area is cultivated, and about the second week in October chou moellier is sown at the rate of 3lb. per acre.

The feeding off of the chou moellier starts in early January after the lambs are weaned and drenched. Chou moellier is also used for the fattening of the culled ewes and before the paddock is cultivated again the flock ewes are turned in to eat off the stubble. During the last week in February the area is double disced twice, harrowed, and sown down in permanent pasture. The sowing takes place during the first week in March.

When this work has been completed a further area of old pasture is ploughed, cultivated, and sown down in greenfeed barley and the abovementioned cropping programme is again carried out. By this rotational method of greenfeed cropping two paddocks, one a greenfeed crop and the other new grass, are available for the grazing of ewes throughout the winter. The permanent pasture mixture used is 60lb. of Certified perennial ryegrass and 3lb. of Certified white clover. This appears to be a heavy sowing, but over a period of years different sowing rates per acre have been used and Mr. Hanrahan contends that the heavy sowing helps to suppress the establishment of weeds and has also proved the most suitable for his soil.

This new grass paddock is grazed systematically until the end of October, when it is closed up for a crop of ryegrass seed. This is the only area on the farm closed for grass seed. The average yield over the past 3 years has been 35 bushels per acre, and last season 1100 bales of threshed hay were saved from 23 acres. Harvesting is done by contract and after the grass seed is machine dressed it is sold, sufficient seed being retained by the owner for his own purposes.

A 3-acre paddock of lucerne is harvested each year, the baled hay being required for the 3 house cows, 2 hacks, and ewes in the mothering pens dur-

MANAGEMENT OF STOCK

ing the lambing period. This paddock has now "run out" and is being prepared for resowing.

A system of topdressing has also been evolved. At present 5 tons of superphosphate are applied annually, paddocks being topdressed every alternate year. In the year that they do not receive superphosphate paddocks are topdressed with lime at 5cwt. per acre. With the exception of the hill block all paddocks are chain harrowed every autumn. When more fertiliser becomes available the owner intends increasing the topdressing applications and oversowing all the steeper hill country. At present only the slips on the hill have been oversown with grasses and clovers.

Carrying Capacity

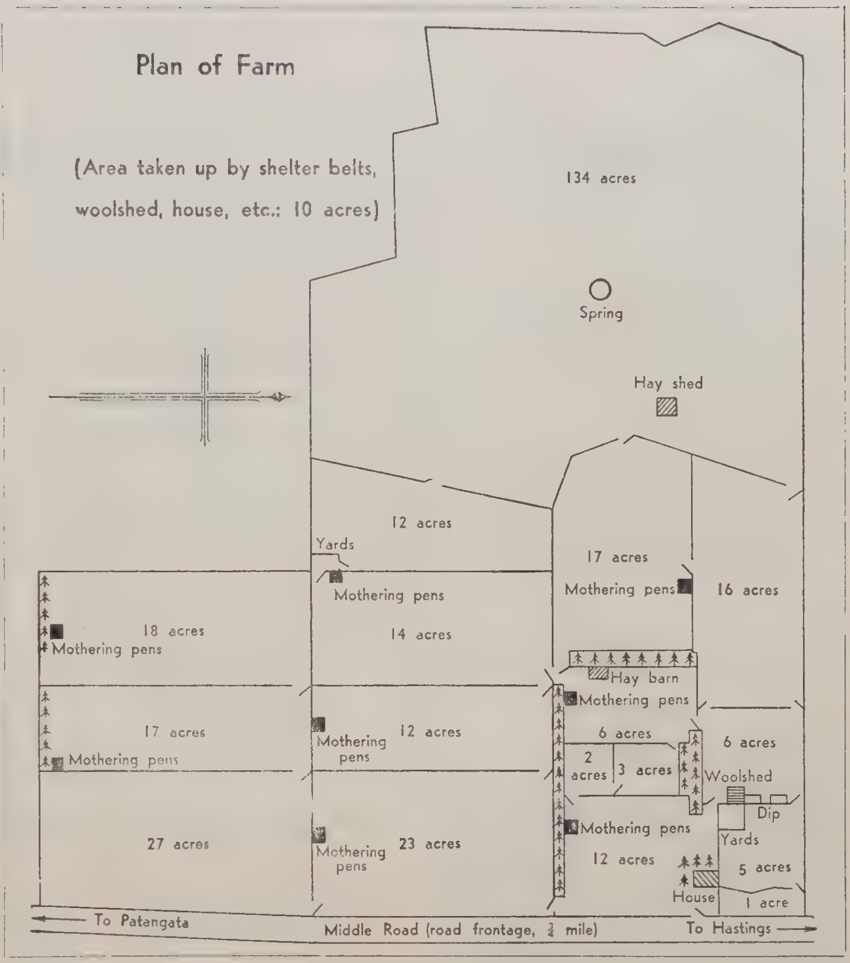
In 1933 the property was carrying 600 to 700 breeding ewes and practically no cattle; today the total stock carried are 1250 Romney cross breeding ewes of mixed ages, 30 to 40 hoggets, 25 rams, and 50 cattle. The owner firmly believes that with the further development of the hill block and increased rotational topdressing and greenfeed cropping a further 200 to 300 ewes could be carried quite comfortably.

Stock Management

Sheep: Every year at the end of January 250 breeding ewes are culled from the flock, all the 5- and 6-year-old ewes being mouthed and culling done by the teeth and not age. Culled sheep are run systematically on the chou moellier and adjoining paddocks and disposed of when fat. Approximately 250 2-tooth ewes are bought in each year as replacements—only the best available lines are purchased—and the flock therefore contains about 250 each of 2-tooth, 4-tooth, 6-tooth, 5-year-old, and 6-year-old ewes.

All sheep are dipped in early February and the ewes are drafted into proportionate mobs for grazing over the farm area. Southdown rams, which are mated with all ewes at the rate of 1 ram to 50 ewes, are put out on February 15 and remain with the ewes until the end of April, when the rams are separated from the aged ewes. The rams are run with the 2-tooth ewes until the middle of May. Foot-rot is not very prevalent on the property, but all lame ewes have their feet trimmed and the whole flock is run through a bluestone trough periodically.

Before they are mated the ewes receive a light crutch, which is carried out by the owner's son and a permanent employee. The ewes are given a full crutch in June, about 6 weeks to 2 months before lambing begins.


Plan of Farm
(Area taken up by shelter belts, woolshed, house, etc.: 10 acres)
134 acres
Spring
Hay shed
12 acres
Yards
17 acres
Mothering pens
16 acres
18 acres
Mothering pens
14 acres
Hay barn
Mothering pens
17 acres
Mothering pens
12 acres
Mothering pens
6 acres
6 acres
2 acres
3 acres
Woolshed
Dip
Mothering pens
Yards
27 acres
Mothering pens
23 acres
12 acres
5 acres
House
1 acre
To Patangata
Middle Road (road frontage, ¾ mile)
To Hastings

Mothering pens situated in a corner of a paddock and well sheltered by a plantation.

In the early winter the greenfeed barley and new grass are grazed off and closed up. After the second crutching the ewes are carefully handled and a number of late-lambing ewes are turned out on to the hill block. The greenfeed crop and new grass are then rotationally grazed by the more forward ewes on the flats. Mr. Hanrahan maintains that half an hour a day on the greenfeed barley is sufficient for a ewe's requirements. With this system of grazing he has eliminated ante-partum paralysis and there has been a marked decrease in ewes suffering from bearing trouble. Early lambing commences in the third week of July, but the main lambing does not begin until the second week in August.

Among the most important assets on the farm, according to the owner, are the home-made mothering pens illustrated on this page. Eight of these small buildings have been erected at different points at no great cost. They are constructed from old packing cases and the roofs are either corrugated asbestos or tarred roofing material and slabs. The floors, consisting either of concrete or light shingle, are covered

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with straw and each pen contains a small rack for hay. The building is 16ft. long, 6ft. wide, 6ft. high at the front, 4ft. high at the back, and is subdivided into 4 small pens by movable hurdles. The farm truck and trailer are used for transporting weak and lambless ewes and motherless and unthrifty twin lambs to the pens for foster mothering. The owner has realised that where ewes and lambs are kept dry and warm successful foster mothering has been doubled and there is no doubt that during lambing operations these pens play a most important part and help to reduce losses to a minimum.

Docking begins in September and the use of rubber rings during the past two seasons has replaced the knife with considerable success. The percentage of lambs tailed is usually 108 to 110, and over the past 8 years has never been less than 105.

In mid-November all ewes that require dagging are put over the shearing board and given a very light crutch. The first pick of lambs takes place about the second week in December when approximately 600 lambs are drafted fat off their mothers. The average weight is between 37 and 40lb.

The ewes and late lambs on the hill block are then brought down to the flats and replaced by dry sheep composed of those ewes from which the first pick of lambs was taken.

Shearing begins after the first draft of lambs is taken (about December 10) when all ewes and dry sheep (rams and hoggets) are shorn. Shearing is done by contract, the fleeces being skirted in the shed and classed in the wool stores at Napier. The average clip is 38 bales.

The second pick of lambs takes place in early January after which the remaining lambs are weaned and given an anti-parasitic drench. The flats and the grass seed area after the crop has been threshed are used for fattening these lambs until early February, when a third pick of lambs is obtained. There are then only 30 or 40 late lambs left and these are carried in the small house paddocks and used as killers throughout the winter.

Rams: Southdown rams of mixed ages are run and the system of culling is similar to that for ewes; 2-tooth rams are bought in each year as replacements.

Steep country on the farm boundary; slips have responded well to oversowing.

Cattle: Fifty Aberdeen Angus-Hereford crossbred steers are carried and are used as an adjunct to the sheep in pasture management. They are grazed on steep country in the winter and are fed a supplementary diet of threshed hay, which is stored in a small shed on the block. In the spring they are removed to the flats where they are grazed until the autumn and then turned back on the hill again to feed off the roughage produced during the summer. The following autumn they are disposed of as fat and replacements are bought, so that approximately 50 yearling steers are purchased every 2 years.

Buildings and Implements

The buildings comprise the owner's residence, a woolshed with a 2-stand shearing plant, a lean-to implement shed attached to the woolshed, shearers' quarters, and men's whare. A hay barn has also been erected and a small corrugated iron shed has been built in a warm gully on the hill for the storage of threshed hay.

The implements consist of a tractor, drill, roller, plough, discs, mower, hay rake, harrows, and a small farm truck and trailer.

The owner's residence, which was built about 7 years ago, is situated on a knoll approximately 200 yards from the main road. The site was decided upon when the property was acquired and a shelter belt of *Pinus radiata* was planted on the southern side at the foot of the slope. Before building started a bulldozer was used to level the site and after this work was completed *Cupressus lawsoniana* trees were planted at the top of the knoll between the house and the *Pinus radiata* shelter.

Owing to the fact that the spring water is somewhat hard, the owner intends erecting a 3000-gallon concrete tank at the woolshed for the purpose of retaining rain-water for the house and sheep-dip requirements.

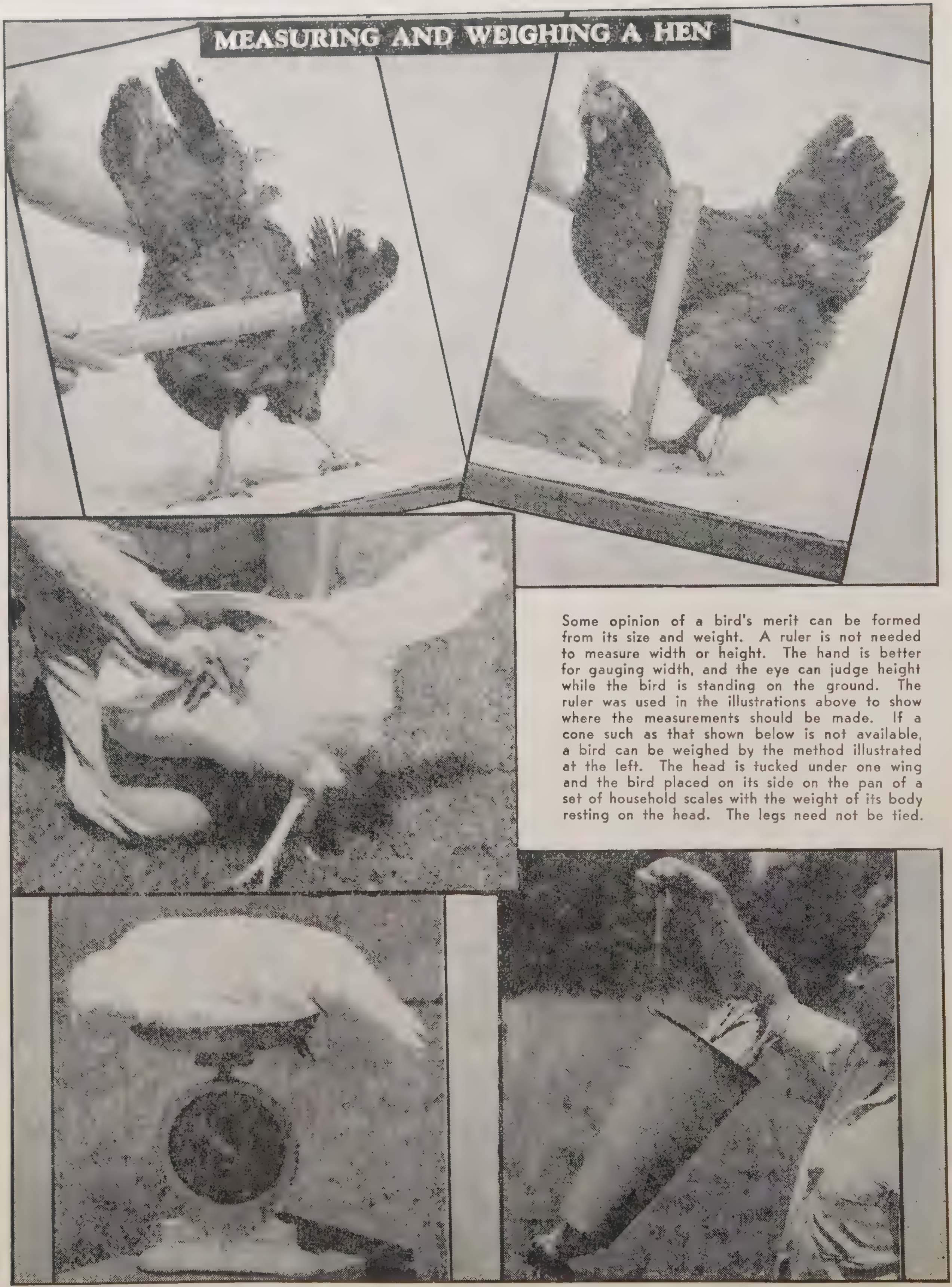
Highly Productive Unit

This farm is a good example of the management in the raising of fat lambs on undulating country surrounding the Heretaunga Plains. Fifteen years of planned and capable management have changed a once average fat-lamb farm to a highly productive unit carrying 1250 breeding ewes, 50 dry sheep, and 50 cattle. Major points in the improvement of the property include sound general management, subdivision, topdressing, reorganising of the water supply and drainage, a planned cropping programme, renewal of depleted pastures, and the use of cattle.

Avenues for further increasing production include the full development of the unploughable hill block by subdivision, topdressing, and oversowing with clovers. The eventual development of the hill country will enable more stock to be carried, or alternatively, carrying a similar number of stock and utilising the flat land to produce more cash crops.

Ewes and lambs grazing on well-sheltered flats.

MEASURING AND WEIGHING A HEN

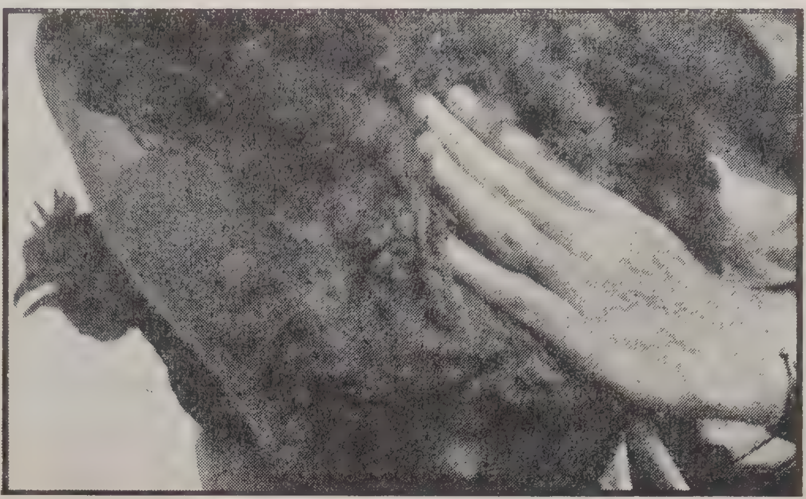


Some opinion of a bird's merit can be formed from its size and weight. A ruler is not needed to measure width or height. The hand is better for gauging width, and the eye can judge height while the bird is standing on the ground. The ruler was used in the illustrations above to show where the measurements should be made. If a cone such as that shown below is not available, a bird can be weighed by the method illustrated at the left. The head is tucked under one wing and the bird placed on its side on the pan of a set of household scales with the weight of its body resting on the head. The legs need not be tied.

[Fraser Niederer photos.

Selection of Second-year Birds for the Household Poultry Pen

FAILURE to cull laying hens regularly is one cause of reduced profits, but even worse is the widespread neglect by household poultry keepers to select only the best-type hens to be retained for a second year and discard the rest. This is a result partly of lack of ability to do the culling and partly of the general belief that all fowls are capable of 2 years' efficient laying. In this month's article, which is a continuation of last month's on culling, W. L. McIver, Poultry Instructor, Department of Agriculture, Hamilton, explains why some birds are not worth keeping for even 1 year's laying and advises how to select hens suitable for keeping longer.

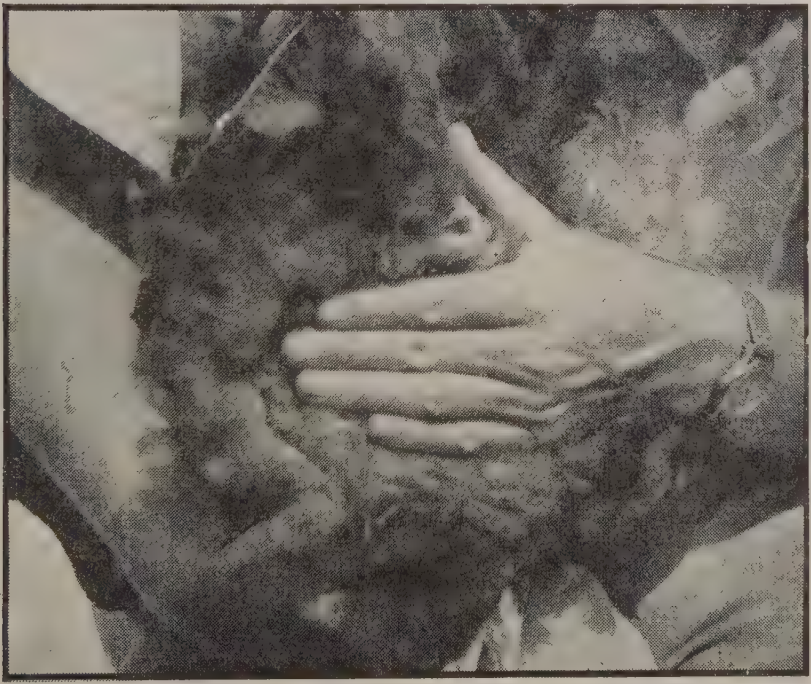


[*Fraser Niederer photo.*

Width and space between the pelvic bones can be judged with the fingers by holding a hand against the abdomen of a hen.

LAST month's subject was culling by deciding whether each fowl is laying at the time of examination and is paying for its food. Selecting birds good enough in type to be retained for another year as layers is far more difficult and cannot be learnt in one easy lesson. A knowledge of the theory is essential, but the smallness of the average backyard flock reduces opportunities for testing theories.

Any novice can easily tell the difference between the characteristics of an outstandingly good type of layer and those of a poor type, but the hens in between do not all fall into one grade intermediate between the best and the worst. The poorest type is better regarded as being fifth grade, so that it becomes necessary to divide the intermediate birds into some grade from second to fourth. This probably explains why many householders will not bother to learn how to select the best hens and reject the balance. Whether learning this art is worth while depends on the housing available for the layers. If the house is divided into two pens, both pullets and hens can be kept, and the owner should learn this subject. If the house is in one unit, it is bad policy to run young and old birds together because the hens tend to bully the pullets and to prevent them from getting their full share of food.



[*Fraser Niederer photo.*

Depth of abdomen is gauged by placing the index finger against the pelvic bones and feeling which part of the hand touches the keelbone.

There are good reasons for keeping pullets for only 1 year's laying in single-unit housing and quitting them all at the end of the season when the new pullets are ready for transfer to the laying house.

If the housing is divided into two units, one should be twice as large as the other. The larger section is for pullets. Usually about half the pullets prove good enough to be kept for a second year, and the smaller unit is then the correct size for the second-year birds.

The merit of the double-unit system is that keeping both pullets and hens assures the household of a daily supply of fresh eggs. Unless the new pullets are from a late hatch and do not come into lay until May or June, there should never be a day in the year without eggs, so that preserving them is unnecessary. There is the possibility that feeding and replacement costs to carry hens through the moulting period may be lower than those of keeping pullets through the growing stage to maturity.

Variations in Laying Ability

The opinion that all fowls are worth retaining for 2 years' laying is unfounded. Birds vary in ability as much as any other livestock. Some need culling out after 4 months' laying; others are good for 4 years. In general culling the decision to be made is whether the fowl is laying or not, but in the selection of hens for retention the inquiry must be pursued

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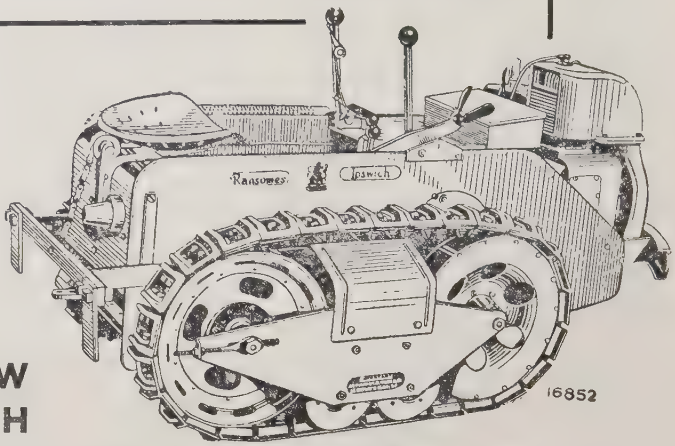
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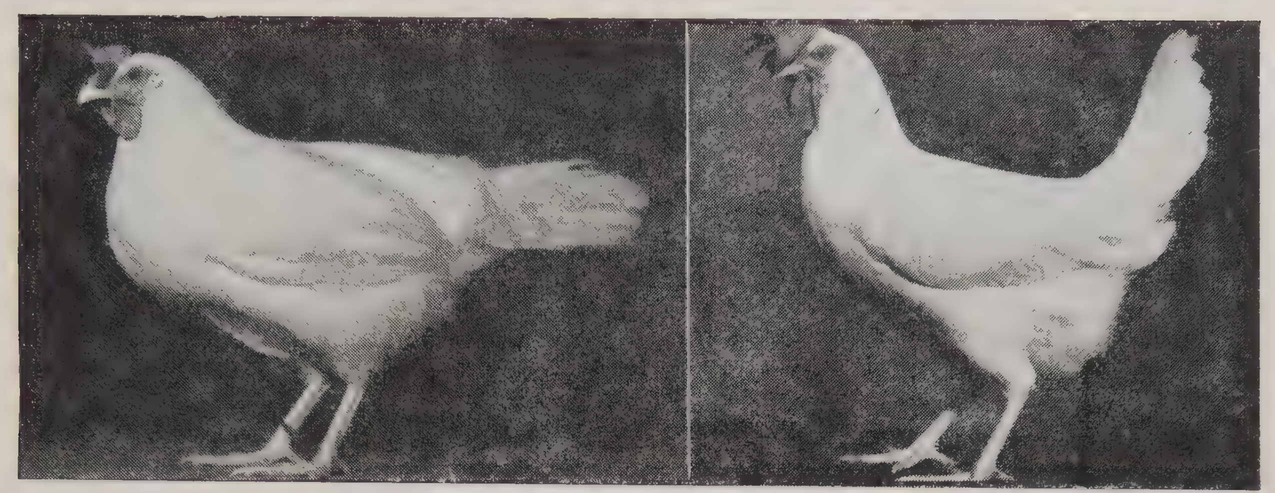


[*Fraser Niederer photos.*

Even the novice has no difficulty in distinguishing a poor type of layer such as that on the left from the desirable type on the right. The grades in between are more likely to present difficulties to the culler.

a stage further and a decision made whether each bird is likely to live another year and continue to lay well.

Most backyard poultry keepers are concerned mainly with laying ability, though a few run their own breeding pens and they, like commercial poultry farmers, are interested in the standard of points for breeding and breed characters. For the householder there is little difference between these two aspects of laying and breeding, and no distinction need be made because an automatic requirement of a good breeder is that it should also be an excellent layer.

Some poultry keepers contend that there is no such thing as "egg-laying type" and that selecting birds by outward appearance is a hit-or-miss system of choosing hens for retention. Trap nesting and single penning are the only reliable ways of ascertaining a fowl's egg yield, and the breeder who wishes to develop an outstanding strain must progeny test the hens to ascertain the family lines which are superior and pass on the best genetical features, but these methods are beyond the economic capacity of most farmers, let alone that of household poultry keepers. Fortunately, most breeders agree that there is a relation between appearance and egg production.

Points which Influence Decision

The decision about a hen's merits will not always be accurate, and sometimes the selector will look at the approved pen of birds a month or so later and ask himself how he came to pass a certain hen. The answer is that the most difficult assessments to make are those of health and stamina. A breakdown can quickly alter the appearance of a hen, and sometimes the moult throws too heavy a strain on a bird, which collapses quickly. However, the selector is not compelled to make an irrevocable decision early in the season. The choice is made on a probationary basis, and the selected hens should be re-examined not only twice more at monthly intervals but again after the moult; that is, just before they resume laying.

The points to be looked for are size and health, type of head and body, freedom from serious breed defects, and signs of laying ability.

Health is difficult to assess. By this time of year adult fowls are at least 15 months old, and if a hen has lived to that age and is still well fleshed and appears healthy and in good laying condition, it will probably stand the strain of another year's laying. Size—that is, the condition of the body and the weight of the bird—can be judged in conjunction with health. Loss of weight could indicate loss of stamina. Consequently the standard weight for the breed must be known. If a White Leghorn hen weighs at least 5lb. or an Orpington 6lb., that is the first sign favouring retention. However, the weight is meant to reflect the size of the framework, as increased body weight through excess fat is far from desirable. Feeling the abdomen and back of the hen enables fatness to be judged and overfat birds rejected.

Size must also be considered in relation to the adequacy of length, breadth, and depth of body. These measurements cannot be given in terms of inches but must be learnt by experience in handling birds. The illustrations show how the handling is done. The judgment is formed chiefly as a result of comparison between members of the flock. If the majority are similar in any one feature, that standard must be correct and too radical a departure from it causes rejection. The hen should be regarded as an egg factory. If there is plenty of space, the work can be done well; if space is cramped, the the output must be reduced. A heavy layer must eat well, and a hearty eater must develop a large abdomen.

Hens that are well conditioned, large for their age and breed, active, and of good vitality are likely to give the best results. Fowls that are undersized, thin, droopy, indolent, loose feathered, "crow headed", and "tucked up" will prove poor producers.

The head should be nicely proportioned, with well-set, prominent eyes. The face should be clean and free from feathers. A fearless, alert expression of the eye shows the good temperament of a keen forager. The body should be well proportioned and deep.

Minor breed defects such as miscoloured feathers, wrong comb shape, incorrect colour in ear lobes, and feathers on the shanks or between the toes concern the breeder, but do not depreciate egg yield. Major faults such as a crooked beak or back, wry tail, a very light-coloured eye, and defects of shanks and toes can all indicate weakness in constitution.

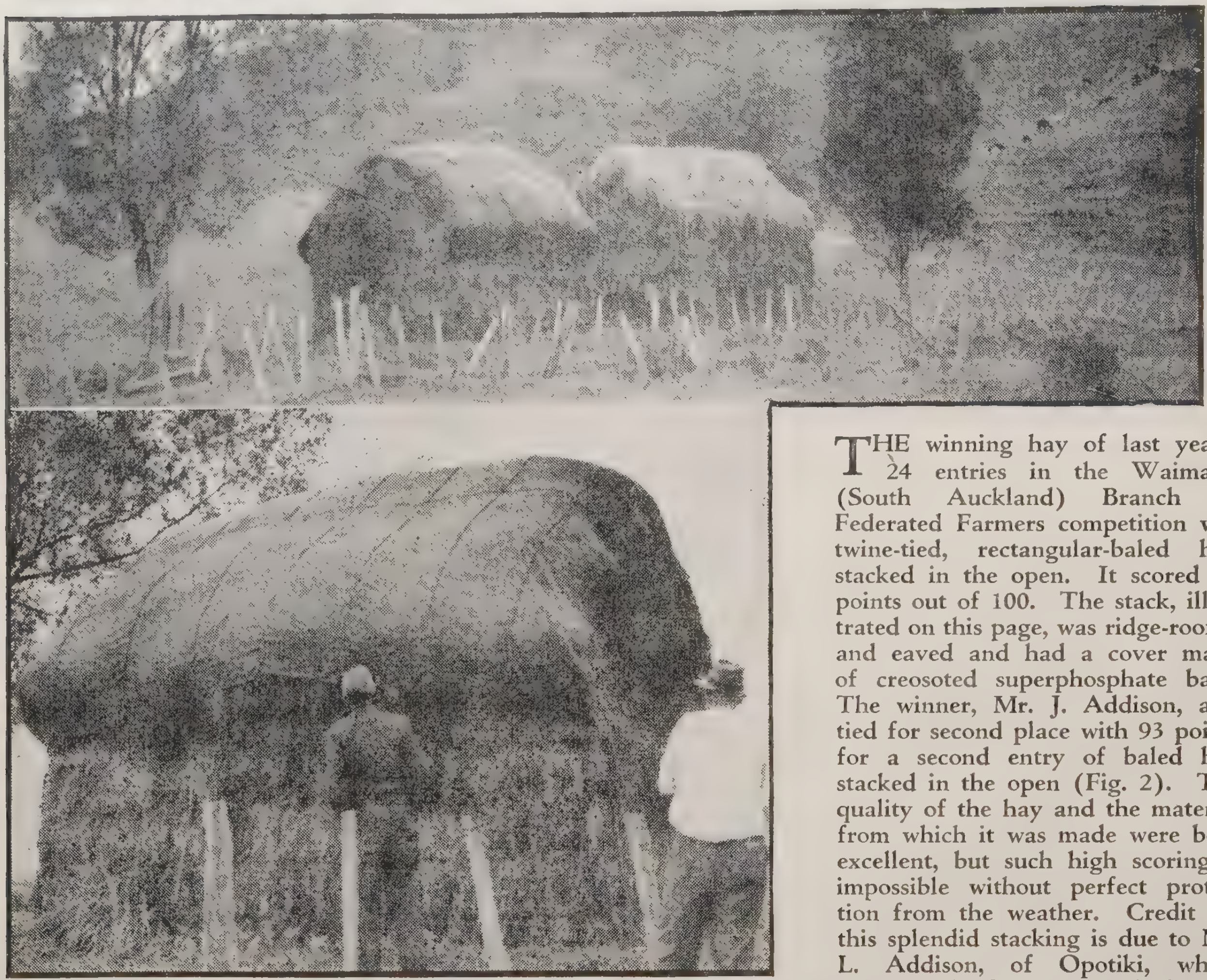
Egg Yield the Major Test

The severest test is that of laying ability. If the bird does not lay well, the fact that it passed all the previous tests counts for nothing. The laying test is concerned not so much with numbers of eggs as with "living and laying". The basis is whether the hen has shown that it can produce eggs over a long period and at the same time retain body condition, health, and stamina. An excellent layer usually begins to lay young and continues to grow in frame, size, and weight. The best birds begin laying early and finish later in the season than average. That is why February is the best month for a major cull and the preliminary selection of the hens for retention and why further examination should be made in March and April. Birds which stop laying early should be rejected and the medium and late layers retained.

The nearer a hen is to going off the lay the less she can stand disturbance, so at all times fowls should be handled quietly.

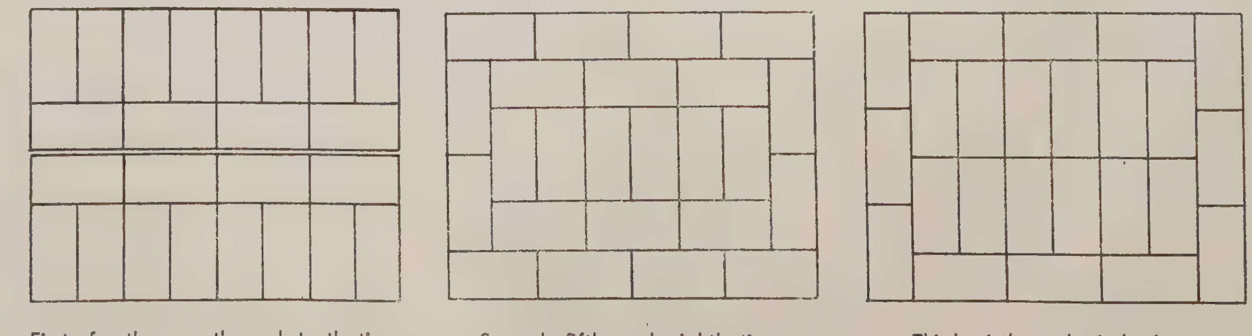
The basis of selecting hens for retention is to use a little theory, add some common sense, take advantage of knowledge of earlier occurrences which may have upset production, employ comparison, and, above all, use powers of observation.

Stacking Rectangular-baled Hay in the Open:



THE winning hay of last year's 24 entries in the Waimana (South Auckland) Branch of Federated Farmers competition was twine-tied, rectangular-baled hay stacked in the open. It scored 97 points out of 100. The stack, illustrated on this page, was ridge-roofed and eaved and had a cover made of creosoted superphosphate bags. The winner, Mr. J. Addison, also tied for second place with 93 points for a second entry of baled hay stacked in the open (Fig. 2). The quality of the hay and the material from which it was made were both excellent, but such high scoring is impossible without perfect protection from the weather. Credit for this splendid stacking is due to Mr. L. Addison, of Opotiki, whose simple and efficient method of stacking rectangular-baled hay in the open is described in this article by E. R. Marryatt, Fields Instructor, Department of Agriculture, Whakatane.

Fig. 1—Upper: Two small Addison stacks of baled hay, ridged and eaved, one with a cover of creosoted superphosphate bags and the other thatched. They are perfect stacks in an ideal situation on well-drained, level, but high ground with trees giving some protection to the ends. Lower: A closer view of the sack-covered stack. This example of excellent stacking of first-class hay scored 97 points out of 100 in the Waimana Branch of Federated Farmers 1950 competition.



First, fourth, seventh, and tenth tiers.

Second, fifth, and eighth tiers.

Third, sixth, and ninth tiers.

Fig. 5—The basic design for the unit of three successive tiers each of 24 bales. Stacks of different sizes can be constructed as multiples of this basic unit of 72 bales. Either the wide or the narrow side can be used for abutting sections.

Efficient Method Devised by Opotiki Farmer

ESSENTIAL features of the Addison method are:—

A level foundation.

Slight tilting inward of the outside bales in the bottom tier by careful packing with loose hay.

Siting the stack end-on to the quarter from which rain comes most often.

Maintaining a constant 24 bales to a tier for a small stack or for a section of a tier in a multiple stack.

Using only three designs in succession for bonding the tiers.

Varying the height of a stack by the number of tiers in each section and the length by the number of sections placed end to end for a narrow stack or side to side for a wide stack.

Placing all bales with a wide side down.

Placing every bale which will have a side exposed to the weather so that the exposed hay will act as thatch and turn water, and not so that it tends to take water.

Selecting only good-sized and well-shaped bales for the corners.

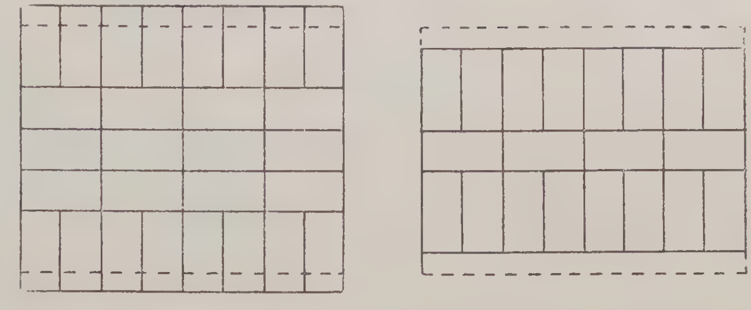
Building perpendicular sides and walls without protruding or receding bales.

Preventing entry of rain from above, either by building an eaved and ridged roof for a treated sack cover or for thatching, or by building a lengthwise lean-to type of roof falling away from the end facing the prevailing rain and covering it with corrugated iron.

Site and Orientation

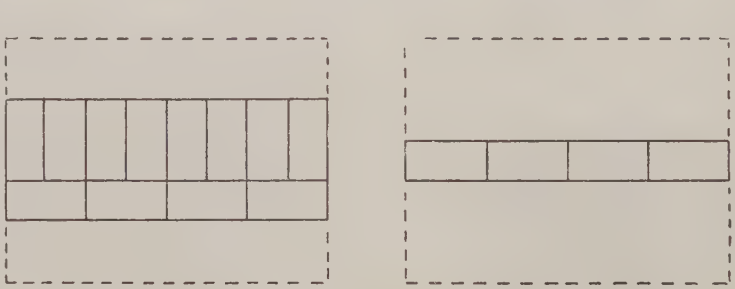
Unless the site for a stack of rectangular-baled hay is level, not even the most expert builder can build a perpendicular stack or, indeed, any stack which is not likely to fall apart. Elevated and well-drained ground which is not subject to flooding is desirable for a site for any stack of hay, but level ground is essential for a stack of rectangular-baled hay. A little loose hay spread evenly is used under the bottom tier, and the outside edges of the outside bales of this tier are raised slightly by carefully placing additional loose hay underneath them. Extra time spent on making a good job of the bottom tier is repaid in the long run, for unless the foundation is good the stack cannot be good.

All rectangular stacks should lie end-on to the prevailing rain. A stack with a lean-to roof running downhill along its length (Figs. 2, 3, 4, and 10) presents the smallest area to the prevailing rain when the short end faces it, but then all the water which runs off the corrugated iron roof is blown on to the end of the stack and a great deal of it may penetrate, causing damage which no amount of later sunshine and wind will repair. Therefore stacks of this kind should have the high end to the prevailing rain, and the iron at the short end should overhang by about a foot (Fig. 4) so that the run-off water will fall clear of the stack. A wide and shallow open drain below this overhang quickly carries this run-off from the immediate vicinity of the stack.



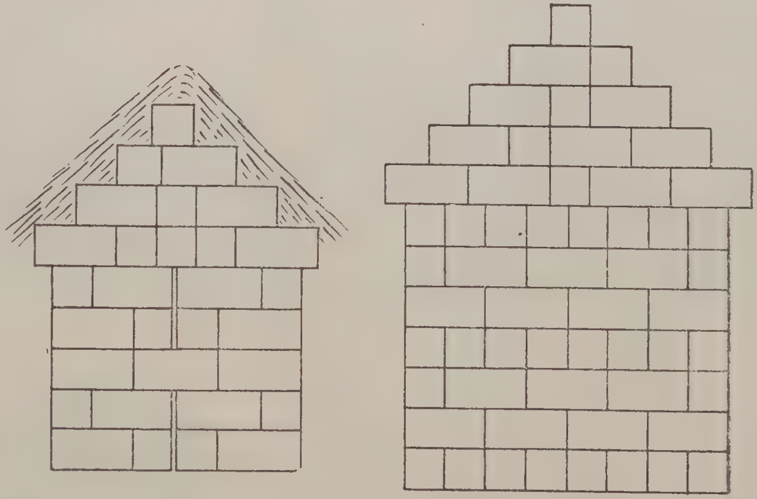
Sixth or eaves tier for a ridged-roof narrow stack.

Seventh tier for a ridged-roof narrow stack.



Eighth tier for a ridged-roof narrow stack.

Ninth or ridge row.



The method of forming eaves and a ridged roof on a narrow stack. The stack is topped off with loose hay, which must be well tramped down into the angles made by the bales and is held in place by a creosoted sack cover. This stack contains 184 bales.

The end of a wider ridged-roof stack, in which the roof section begins at the eighth instead of the sixth tier. From the eaves tier upward the bales are continued the length of the stack as they appear in this diagram; that is, lengthwise or crosswise. Each unit of this multiple stack contains 268 bales.

Fig. 6—Designs for eaves and a ridged roof. The diagram of the end of the narrow stack represents the sack-covered stack in Fig. 1 without the cover.

STACKING RECTANGULAR-BALED HAY IN THE OPEN

Fig. 2—An Addison-type stack with the top sloping from one end to the other and covered with corrugated iron which is kept on by weights hung from cross-beams laid over it. Fig. 3—Two more stacks of similar type. On the nearer one the iron is held down by concrete blocks, made in kerosene-tin moulds, resting on cross-planks. The netting fence has the advantage of being very easy to erect or take down.

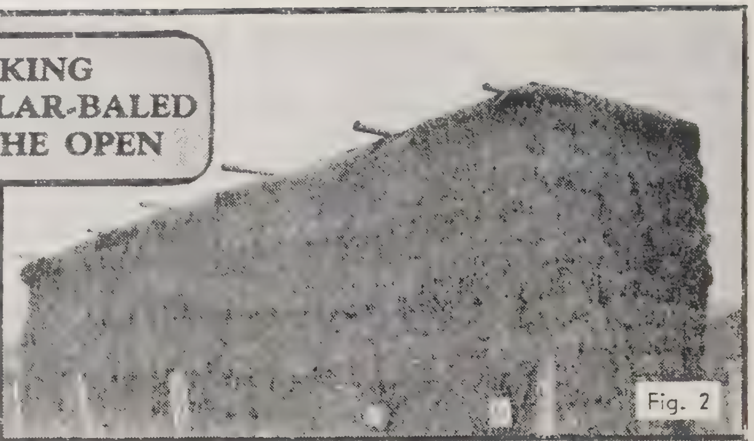


Fig. 2

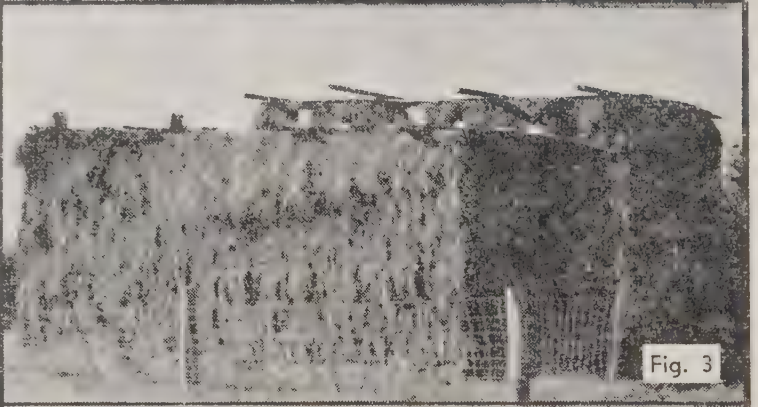


Fig. 3

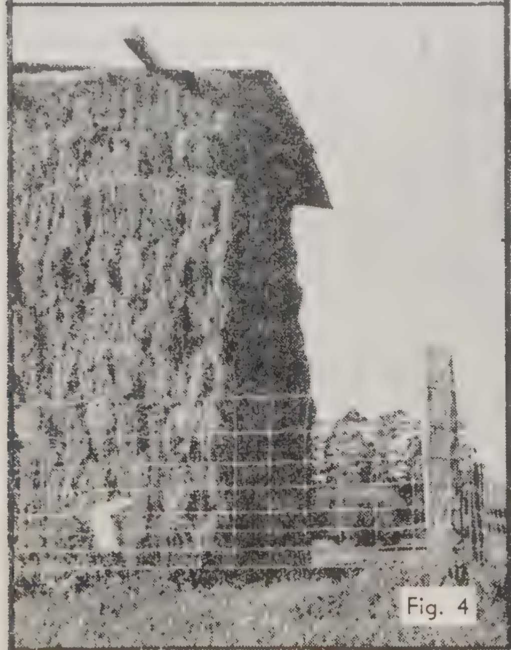


Fig. 4

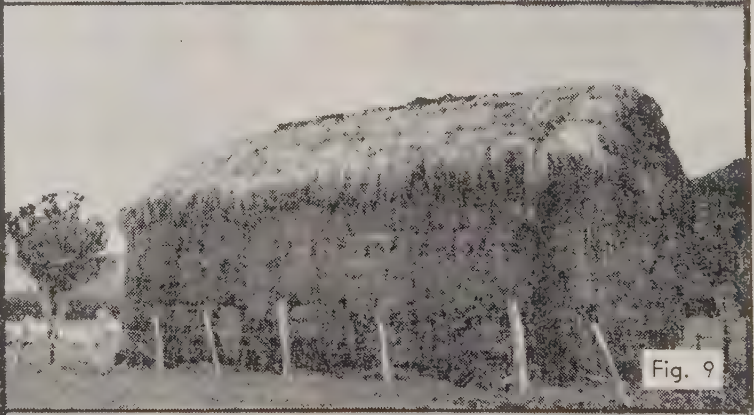


Fig. 9

Fig. 4—The overhang on iron roofing is necessary to prevent run-off water from penetrating the bales at the end of the stack. Fig. 9—An Addison-type stack with eaves and a thatched ridged roof. It had been standing for 18 months when it was photographed. Fig. 10—A stack which illustrates some of the best features of this method of stacking and fencing rectangular-baled hay.

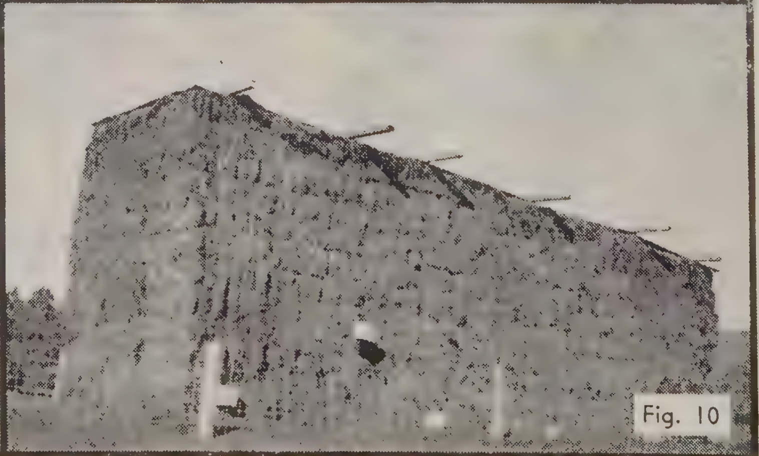


Fig. 10

Basis of Design

The make-up of each section of an Addison stack is shown in Fig. 5. For small stacks the narrow sides of the sections form the width of the stack and the sections are placed narrow side to narrow side as shown in Fig. 7. The competition-winning stack and the neighbouring thatched stack in Fig. 1 are examples of this. Larger stacks may be built either as multiples of this base by abutting additional tiers alongside the first as in Figs. 7 and 8 or by expanding the capacity as in Figs. 7A and 8A. Figs. 3, 9, and 10 show stacks built by this expansion method, and not multiple stacks.

Sections of stacks may be built alongside each other as close as possible and need not be interlocked. This requires very careful stacking of good bales, but it makes for ease and convenience in feeding out by sections, and if all is not required at one time, the remaining sections are as weather proof as was the whole stack before feeding out was begun.

An important feature of the design for the first or bottom tier is the gap of 4 to 6in. left in the centre between the two rows of four bales each running lengthwise (Fig. 5). This gap serves three purposes: It tends to allow for uneven lengths of bales and so assists in preventing protruding bales. It helps heat and moisture to escape. This gap may recur in various parts of the stack through uneven sizes of bales, but unless it is left in the bottom layer some bales are likely to protrude in subsequent layers. A little loose hay may be inserted in the gaps on the weather end of the stack to keep out driving rain. The third advantage of the gap is added stability through having the tier of the greatest surface area at the bottom of the stack.

Placing of Bales

Each bale is placed on a wide side to assist stability. A bale made in a slice baler has one narrow side cut, and in the opposite side all the hay ends point in the same direction. The bales in the walls should be placed with the hay ends in the uncut narrow sides pointing downward, giving a thatching effect so that they will turn water as will thatch. If a bale is placed in any other way, either the cut side is outward or the straw ends point upward, tending to take water instead of turning it. Once this feature of a sliced bale is known to exist the correct way in which to place it can usually be seen readily, though some bales show it more than others.

Only the best bales are selected for the walls, and particularly for the corners, and care is taken to build perpendicular and flush walls; if there is any departure from the perpendicular, it is only very slight and only inward. Diversion from these principles may lead to a breaking down of the stack or spoil its water-proof qualities.

After the bottom tier has been built carefully the ends of each succeeding tier must be completed before the centre; that is, the last bales placed in a tier other than in the bottom tier must be toward the centre. Only in this way can good and lasting corners and ends be built.

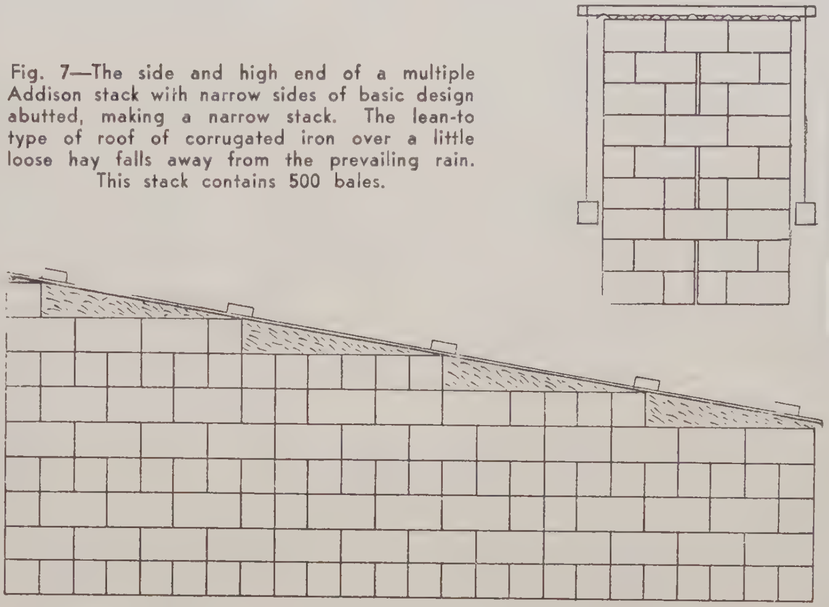
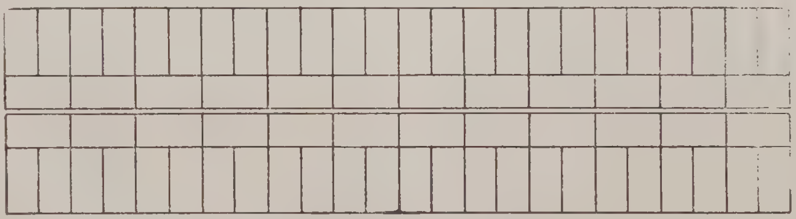
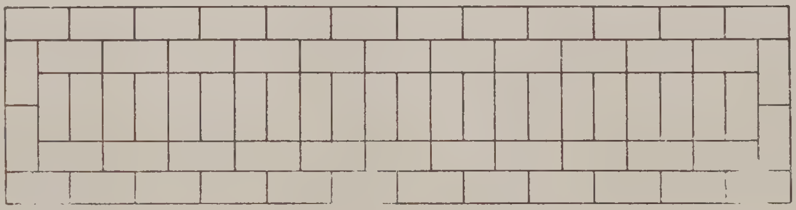


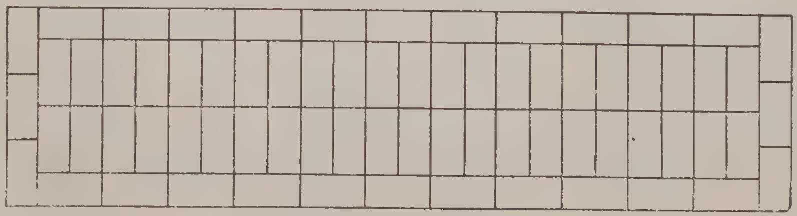
Fig. 7—The side and high end of a multiple Addison stack with narrow sides of basic design abutted, making a narrow stack. The lean-to type of roof of corrugated iron over a little loose hay falls away from the prevailing rain. This stack contains 500 bales.



First, fourth, seventh, and tenth tiers.



Second, fifth, and eighth tiers.



Third, sixth, and ninth tiers.

Fig. 7A—Expanded tiers for larger stacks. The 24-bale tier has been expanded to 72 bales, but may be expanded in multiples of 6 bales. The end patterns must be maintained and additional bales added only toward the middle. This is the design for a stack three bales wide.

STACKING RECTANGULAR-BALED HAY . . .

Sometimes the gap left for the last bale in a row is a little too small. Then this bale and the preceding one should be tilted away from each other above the double gap and forced in. This is quite satisfactory if the gap is well away from the ends, but it is an unwise procedure near the ends. If the gap is too small, the last bale is better left out.

Roofing the Stack

Designs for tiers for an eaved and ridged roof are shown in Fig. 6. This method is very satisfactory for use with a treated sack cover and for thatching (Figs. 1 and 9). Where corrugated iron is available the lean-to type shown in Figs. 2, 3, 4, and 10 is a perfect method of roofing. No wires press against the hay to encourage entry of water, for the weights are either placed on the roof itself, as in Fig. 3, or tied to wires which hang well clear of the stack from poles laid across the roof, as in Figs. 2 and 10.

Making a Sack Cover

Mr. J. Addison makes his creosoted sack covers in spare time or on wet days. He finds them inexpensive and very efficient. If well made, they last for several years. The cover on the competition-winning stack in Fig. 1 was made from 24 opened superphosphate bags sewn together in three rows of eight. Mr. Addison points out that superphosphate rots sacking and that it is of little use trying to make a sound cover out of partly-rotted bags, or even out of sound bags if superphosphate is left in the material. Therefore he stresses the need for thorough washing of sound bags in several waters before sewing is begun. All bags are not the same size and some care is required in arranging the order before beginning sewing. Ordinary sewing twine is used.

When the sewing has been completed the creosoting can be done on a fine day in a concrete yard by folding the cover up, pouring creosote over it, and manipulating the cover so that no part of it remains untreated. When thoroughly soaked it is hung to dry; it should be dried thoroughly before the rain is allowed to fall on it.

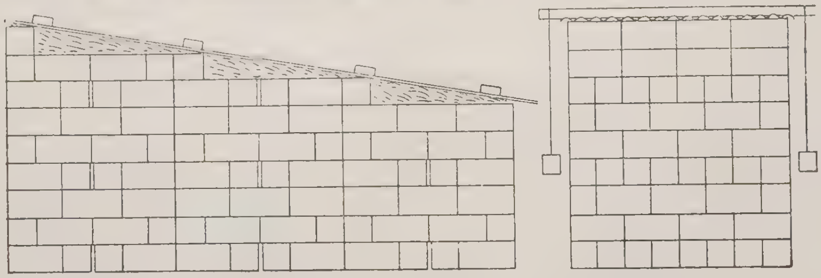
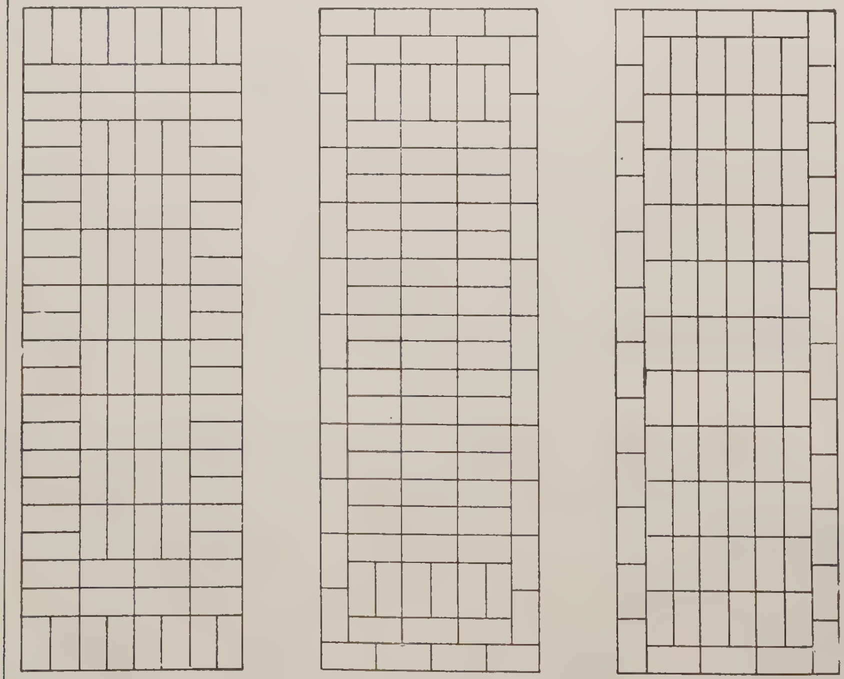


Fig. 8—The side and high end of a multiple Addison stack with wide sides of basic design abutted. This method of abutting units may be adopted for the largest stacks. This stack contains 516 bales, but could easily take another section at the low end, adding another 124 bales. More tiers can safely be built on these wider stacks.



First, fourth, seventh, and tenth tiers.

Second, fifth, and eighth tiers.

Third, sixth, and ninth tiers.

Fig. 8A—Expanded designs for larger stacks four bales wide.

BOOK REVIEW

"World Outlook and State of Food and Agriculture"

THIS publication gives a useful and comprehensive review of the world outlook in agriculture for the next 2 years. No authority is better qualified than FAO to make this assessment of production, consumption, and trade of all important commodities of the soil and the sea.

In a brief introduction the view is expressed that purchases overseas by the U.S.A. for rearmament and stockpiling will place more dollars in the hands of other countries, enabling them in turn to buy increasing amounts of food from North America. In these countries widespread expansion of military programmes will lift spending power and intensify in many countries the already strong demand for food and agricultural products. At the same time a slight increase of agricultural production is forecast in almost all areas of the world.

Livestock products, which are of greatest concern to New Zealand, are expected to increase in volume mainly in two areas, Western Europe and North America. Meat production in Europe will, however, still remain below pre-war levels, and prices will therefore be firm to rising. FAO envisages an increasing demand for dairy products, particularly for fluid milk and cheese, but this may not apply to butter. Nevertheless butter prices are expected to rise because production may possibly decline in favour of alternative dairy products.

Useful tables are appended to this report, giving for instance the relation of food prices to wholesale prices in recent years and estimated energy and protein intake per head in various countries. From the latter table instanced it will be realised that in spite of the bright outlook for production and trade hundreds of millions of people, particularly in the Far East, will still not have enough to eat.

This FAO review treats with some detail the prospect for a large number of agricultural, fisheries, and forestry commodities and the general economic outlook by various regions. It should be read by anyone interested in the problems of world agriculture and its causal relations to world events.

—*C.D.*

Food and Agriculture Organization of United Nations, Washington, price 1 dollar.

Solutions for Cleaning Milking Machines

Alternative Materials to Caustic Soda: Some Detergents Nearly all Water

THE first influence on the quality of dairy produce is the care with which milk and cream are handled in the milking shed. In this article by G. M. Moir, Dairy Chemist, Department of Agriculture Animal Research Station, Wallaceville, the value of caustic soda solution for cleaning milking machines is explained and compared with that of other soda compounds. The properties of "wetting agents" which are useful for adding to soda mixtures are described and are contrasted with those of other new chemicals which should not be used to clean milking machines.

WHEN milking machines first came into common use about 30 years ago the cleaning of the complicated apparatus soon caused trouble. The most successful method devised was based on the use of caustic soda dissolved in boiling water at the rate of 1 teaspoonful per gallon, which is about 1 part in 500. This caustic soda solution has several important advantages: It dissolves casein and milk residues very readily; it converts butterfat into soap; and it is a very powerful germ-killing agent.

Cleaning and Germ Killing

The turning of fat into soap by caustic soda is very important in checking the penetration of butterfat into rubberware, and that was clearly demonstrated in experiments arranged by J. M. Kristensen, Special Inspector, Dairy Division, Department of Agriculture. Those trials were described on page 300 of "The Journal of Agriculture" for October, 1950. Briefly, four sets of inflations were used on a Taranaki dairy farm for nearly 4 months to milk a herd of 35 cows. Each set of teat-cups was washed in a different way, and the following table, giving the average amounts of fat absorbed by the inflations during the period of use, shows that caustic soda used twice daily is definitely superior:—

Cleaning method	Fat absorbed (grammes)
Caustic soda and boiling water twice daily	1.61
Caustic soda and boiling water once daily	2.57
Caustic soda a.m., washing soda p.m.	2.28
Washing soda twice daily	3.23

The germ-killing ability of caustic soda increases with the temperature of the solution. That was demonstrated by American experiments carried out about 25 years ago. In America a ½ per cent. solution has been used cold successfully for many years to fill up the teat-cups and rubber connections between milkings. Recent American investigations have shown that the principal source of heat-resistant bacteria in milk is poorly cleaned teat-cup inflations, and have also demonstrated the value of a hot caustic soda solution for cleaning the inflations and getting rid of these undesirable germs. English investigations have shown that a caustic soda solution very efficiently destroys coliform bacteria, which are an important cause of defects in the quality of milk and cream.

Strength and Temperature

The use of caustic soda has often been objected to because of its dangerous properties. Some farmers collect the hot solution from the milking machines and use it for washing such equipment as buckets and cans, but at the strength of 1 part in 500 this solution may damage the skin seriously, causing chaps and sores, and it also removes tinning from pipes and utensils. Because of these objections difficulty was met in persuading some farmers to use caustic soda. Instead they used washing soda, which is very much less efficient, even in large quantities To meet these objections the recommended strength of the solution was reduced, and since 1933 the amount specified has been 1 teaspoonful of caustic soda to 4 gallons of boiling water, which is about 1 part in 2000.

Since then another factor has arisen. At the time the strength was reduced many of the best dairy sheds had good facilities for heating water in fuel heaters fired with wood, coke, or coal; when properly fitted up such a heater gave not merely boiling water, but also steam. However, many dairy farmers still used an ordinary domestic copper, which they usually fired once daily, and when fuel was short the water often was not boiling. During the years 1930-34 electric power was in ample supply, and to stimulate the use of electricity for water heating it was sold to dairy farmers at very low rates. The result is that now most dairy farmers use electric power to heat water, and therefore there is probably more hot water available but distinctly less boiling water.

Thus two factors, the reduced caustic soda strength and the lower temperature of the hot water, have combined to give less efficient cleaning of milking machines.

This subject was discussed early last summer with the Supervisor of Farm Dairy Instruction, Department of Agriculture, who arranged to have trials carried out on two Waikato dairy farms where the machines were not as well cleaned as they should be. Slime and milkstone deposits were evident in various places. The water used never boiled, the average temperatures on one farm being in the morning 181 degrees F. and in the evening as low as 151 degrees F., and on the other 169 degrees F. and 157 degrees F. Before and after the main period of trial a weaker caustic soda solution was used, and the strength was increased during the trial to 1 teaspoonful of caustic soda per gallon of hot water. A few samples of milk were tested for bacterial count, and the results showed decisively the benefit of using a stronger caustic soda solution, which enabled milk of lower bacterial count to be obtained. These results were obtained by using the hot caustic soda solution twice daily, which is not as common as it should be.

Trials with Soda Ash

Because of the objections many farmers have to the use of caustic soda the writer endeavoured years ago to develop a soda ash mixture which would be a suitable alternative. (Soda ash is dried washing soda; that is, it lacks the water contained in the crystals, which are really only one-third soda ash.) This mixture consists chiefly of soda ash, with 15 to 25 per cent. of metasilicate of soda and about 10 per cent. of tri-sodium phosphate or another phosphate compound, calgon. These added soda compounds have valuable water-softening and cleaning properties which enable particles of fat and dirt to be rinsed off the equipment with ease. Several trials were made with this type of mixture, some being more successful than others. The longest trial, lasting a year, was arranged by the Supervisor of Farm Dairy Instruction, who reported that when used alone the soda ash mixture was better than caustic soda for preventing formation of milkstone, but not as good as caustic soda for keeping the milking rubberware in satisfactory condition. Other reports were more strongly in favour of caustic soda. In view of the objections to the use of a stronger caustic soda solution, when the water is not hot enough it is preferable to increase the strength of the cleaning solution by using other soda compounds.

The table which follows explains how to use the soda ash mixture with caustic soda and combine the good properties of both. When lumpy or caked the soda ash mixture may need to be broken up before use. Washing soda is weak because it is two-thirds water. The table shows the amounts of soda compounds needed with 3 to 4 gallons of boiling water for washing machines twice daily to give the cleaning value stated:—

Value	Soda compound	Amount
Extra good ..	Soda ash mixture (add first) with caustic soda	At least 1 heaped teaspoon of soda ash mixture and not more than 1 heaped teaspoon of caustic soda
Good	Caustic soda alone	1 heaped teaspoon
Fair	Soda ash mixture alone ..	4 heaped teaspoons
Weak	Washing soda alone ..	1 large cupful

SOLUTIONS FOR CLEANING MILKING MACHINES . . .

Wetting Agents

The efficiency of a soda ash mixture can be improved further by the use of a suitable "wetting agent"—a chemical which enables water to spread uniformly over a greasy surface. Soap acts as a wetting agent, but is not recommended for washing milking utensils because it is difficult to rinse off. Other synthetic chemicals have been used in the textile industry for fully 40 years to ensure that washing and dyeing solutions really wet and make close contact with wool or cotton fibres. In recent years improved synthetic wetting agents have become available, such as sodium lauryl sulphate, alkyl aryl sulphonate, or polyethylene glycol compounds. These and similar types of wetting agents are sold under various trade names, and provided they mix readily with caustic soda compounds (including soap) they can improve the cleaning efficiency greatly.

The cleaning value of a soda ash mixture similar to that listed and containing two wetting agents has been demonstrated by recent trials undertaken by W. G. Whittleston, Physical Chemist, Department of Agriculture Animal Research Station, Ruakura. The cost of such a mixture compares favourably with that of caustic soda and there are prospects that by reducing the proportion of the expensive wetting agents and increasing the soda ash content it can be made cheaper.

Whether such a mixture will displace caustic soda for cleaning milking machines has yet to be established, and to decide this further trials will be needed. Certainly any mixture of similar composition will give better results if it is used with caustic soda.

Other Detergents

Partly as a result of the acute shortage of caustic soda for a period after the war, other cleaning solutions have been sold rather widely in recent years by high-pressure propaganda. This type of detergent is usually a solution of a new type of synthetic called a quaternary ammonium compound. The percentage of water in these solutions is usually much higher than that in washing soda crystals, which are two-thirds water. Quaternary ammonium solutions which are being sold to dairy farmers usually contain at least 90 per cent. of water. One sample of a solution which was analysed at Wallaceville about 2½ years ago contained nearly 98 per cent. of water. During the intervening years this type of solution has been sold to many dairy farmers, who must have paid a large amount of money for the freight on its water content.

However valuable such solutions may be for veterinary purposes, they are not recommended by the Department of Agriculture for washing milking machines and utensils. Two reasons may be given: First, these quaternary ammonium compounds are not compatible with soap and other caustic soda compounds, because the wetting properties of each neutralise that of the other when they are mixed; second, trials have shown that quaternary ammonium compounds have no value for removing butterfat from milking machine inflations. For a period of from 2 to 4 hours daily inflations are applied to the cows' teats. A film of milk gathers between the teats and the rubber, and some of the fat in this milk is gradually worked into the rubber by the vigorous squeezing which is going on all the time. As the flow of milk falls off, the strippings become richer in fat, which is then taken up by the rubber even more readily. This fat causes the inflations to swell and lose their elasticity, so that they become too slack to milk efficiently. Moreover, the fat can cause the rubber to perish more rapidly, especially where it is stretched by the ring at the mouth of the teat-cups; this part of an inflation therefore perishes most rapidly and soon develops tiny surface cracks, in which more fat and dirt can lodge and speed up the damage, especially if hot water and soda are not used twice daily.

Recent complaints about the rubber of teat-cup inflations being unsatisfactory seem to be the result of the use of unsuitable quaternary solutions. Before changing to new washing and rinsing compounds or detergents which are claimed to supersede caustic soda, a dairy farmer is recommended to ask the advice of the local Farm Dairy Instructor. If he should not be available, a note may be sent to the Director of the Dairy Division, Department of Agriculture, P.O. Box 3004, Wellington, with a sample and particulars of the compound.

Water-heating Systems

Another obvious way of improving the cleaning of milking machines is to use hotter water, but that is impossible with the present electricity supply. Much better is the installation of an up-to-date type of fuel-burning water heater, especially one of the oil-fired type capable of giving not merely ample boiling water, but also steam, which is essential for the cleanliness which will allow the production of the best milk, especially for town supply.

However, even when steam is available the dairy farmer must still take care to carry out regularly twice daily the best methods of cleaning his equipment by the liberal use of cold water to rinse the machines, followed by suitable soda solutions in boiling water rinsed off with more boiling water.

HEADER harvesters, like most harvesting machinery, have many moving parts which may require to be set or regulated from time to time. The drum may slip, a belt may shred or a chain snap, parts may need grease, and blockages may have to be removed by hand. Danger is most likely to occur when more than one person is engaged on this work and machinery is put in motion without care being taken to ensure that some one else's hands or arms are not in a place where they may be caught. Sometimes a bystander may try to help and through lack of knowledge of the machine may endanger himself and increase the responsibility of the operator.

Precautions to be observed to avoid danger are:—

Have only a responsible person in charge.

Remember that belts, chains, pulleys, drums, and other moving parts have no mercy on fingers.

Look all round before setting the engine or power take-off in motion for travel or for operation.

Do not attempt to adjust or clean moving parts without stopping the machinery.

Keep children at home, or at least at a safe distance, as they are very difficult to see in grain crops.

—*J. N. WHYTE, Farm Machinery Instructor,*
Department of Agriculture, Dunedin.

Pests and Diseases of Fruit Trees in New Zealand

THERE is a fairly wide range of insect pests and diseases affecting fruit trees and fruit in New Zealand. A knowledge of the various types is necessary to assure efficient control and in this article T. Conway, Orchard Instructor, Department of Agriculture, Hastings, describes briefly and simply the methods of classifying insect pests and diseases, groups the more common pests and diseases in their respective classifications, and indicates the various control measures.

TO understand better both the identification and the control of insect pests and diseases it is essential for those concerned in their control to know not only the kinds of insect pests and diseases affecting the different types of fruit trees, but also to have some appreciation of the method of dividing them into classifications and the need for doing this. Unless these matters are understood it is possible that control measures may be quite ineffective or only partially satisfactory. Scientific investigation, covering practically all aspects of control, is based on the different classifications into which insect pests and diseases fall. Therefore the various control measures officially recommended to growers must be used accordingly, and, in most cases, it will be found that control measures are similar for insect pests or diseases characteristic of a specified type.

Once the classification is known the method of approach to effective control can be understood more readily.

Classification of Insects

Briefly, insects are divided into three main types, depending on their method of feeding, as follows:—

The chewing types—grubs, caterpillars, beetles, etc.
The piercing-sucking types—aphides, scales, etc.
The rasping-sucking types—thrips.

The chewing type of insect has biting mouth parts and is able to bite off, masticate, and digest small pieces of plants or fruits. The mandibles (jaws) are the essential parts of the chewing insect. They are comparatively large, horny organs roughened or serrated so that the insect can tear or grind at plant tissue. The mandibles are moved from one side to the other by powerful muscles in a grinding motion. To control chewing insects effectively a stomach poison such as lead arsenate generally must be used as a spray; particles of the lead arsenate are eaten and digested when the insects are feeding. D.D.T. is a notable exception, however, as it acts both as a stomach poison and contact insecticide against chewing insects.

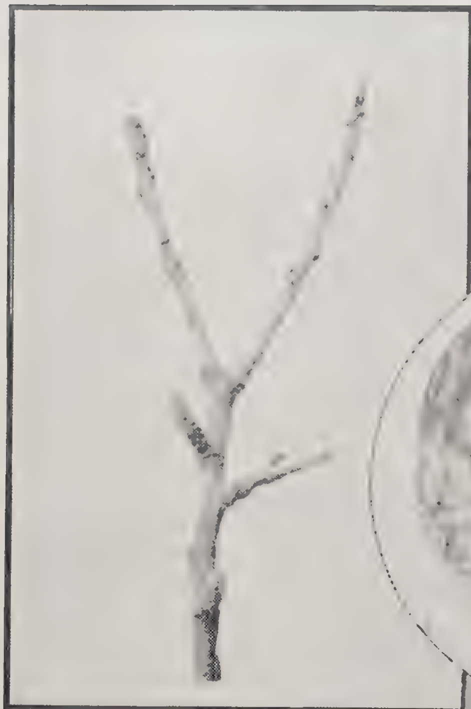
The piercing-sucking type of insect does not bite off pieces of plant tissue, as it does not possess suitable mouth parts for this purpose. It can, however, pierce the epidermal tissues of plants and fruits and secure food by withdrawing sap and juices.

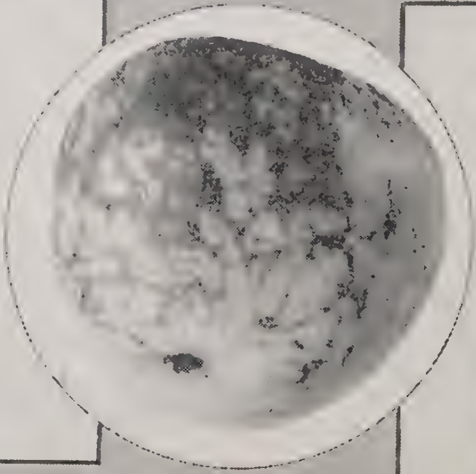
In the piercing-sucking insect there is an adaption of certain portions of the mouth parts of the chewing insect to form a prolonged, flexible, finger-like part called the rostrum. This organ is used mainly as a sheath for carrying the modified mandibles and maxillae, in the form of four slender, needle-like stylets, down a channel or slot in the front portion of the rostrum. When in use these form one needle-like and flexible tube, with two channels. Saliva is poured down one of these channels and liquid foods are drawn up through the other. This needle-like tube is forced into the plant tissue by an up-and-down motion.

As the food is withdrawn from the internal structure of the plant tissue, a stomach poison which adheres to the external areas of plants only is of course ineffective as a control. Contact insecticides such as mineral oils, nicotine sulphate, derris, pyrethrum, D.D.T., selenium, and lime sulphur are therefore required. These materials have varying effects on sucking insects, such as a corrosive action on the cuticle, suffocation, or paralysis of the nervous or breathing systems.

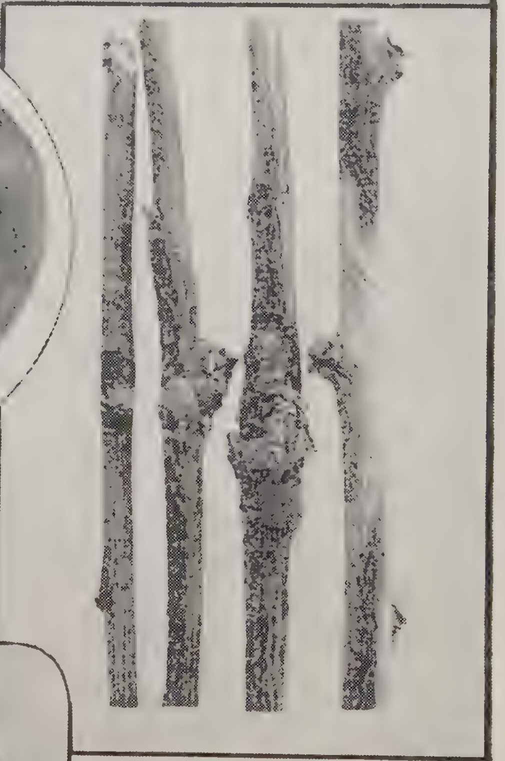
Photograph in heading by Sparrow Industrial Pictures Ltd.

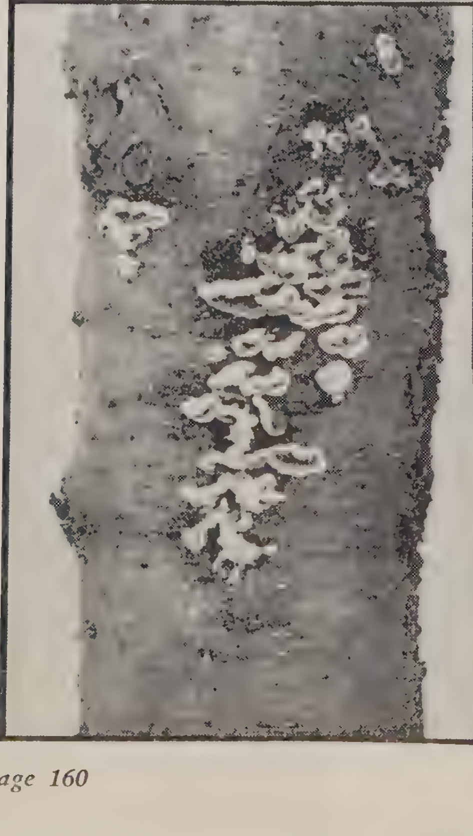
FUNGUS DISEASES AFFECTING FRUIT, WOOD, AND FOLIAGE OF ORCHARD TREES

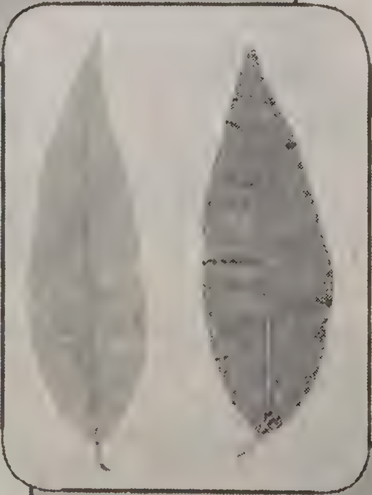


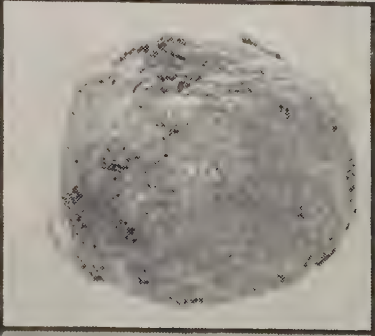


Effects produced by powdery mildew *(Podosphaera leucotricha)*, an ectoparasitic fungus disease common on apples. Above—Affected tips of young growth on an apple. In circle—Powdery mildew on an apple.

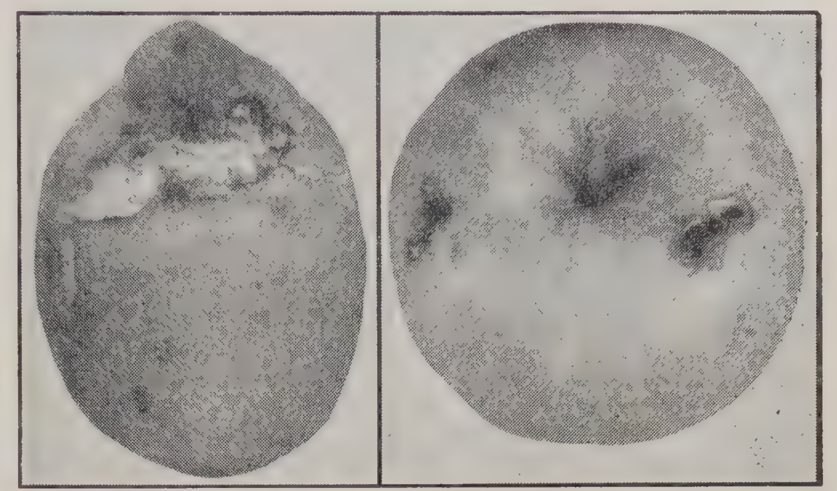








Examples of endoparasitic fungus diseases. Left—Silver leaf *(Stereum purpureum)*, a disease of fruit trees and many other trees. The illustration shows fructifications on peach wood. Middle—The typical silvering caused by silver leaf disease is shown on the leaf at left; on the right is a healthy leaf. Upper right—Brown rot infection on peach twigs. Lower right—Brown rot on a peach. The fruit shown is capable of carrying over infection to the following season and fruit such as this should be destroyed.



Fruits injured by chewing insects. Left—Lemon injured by leaf-roller caterpillar (*Tortrix postvittana*). Right—Apple injured by codling moth (*Cydia pomonella*).

The rasping-sucking type of insect is able to rasp the epidermal tissue from the plant and then suck up the sap or juices exuding from the scored surface. It is intermediate between the chewing and the piercing-sucking type, with one of the mandibles of the mouth parts greatly reduced, but the general structure is similar to that of the piercing-sucking type. The main difference is the existence of a rasping device to score the epidermal tissue.

As the actual food once again comes from within the plant tissue, a stomach poison on the surface is ineffective. A contact insecticide is therefore required as indicated for the piercing-sucking type. As D.D.T. is both a contact insecticide and stomach poison, it is proving effective against thrips (rasping-sucking type insects). Though D.D.T. appears to be ineffective against many other sucking insects, its possibilities have not yet been fully investigated.

The mites form a section of orchard pests which are not true insects, but are closely allied to the spiders. However, the mouth parts are somewhat similar to those of the other sucking insects described, especially the thrips, and consist essentially of two piercing and rasping stylets which rupture the plant tissue, allowing the mites to suck up the exuding sap.

Classification of Diseases

Diseases are generally classified as follows:—

Fungus Diseases

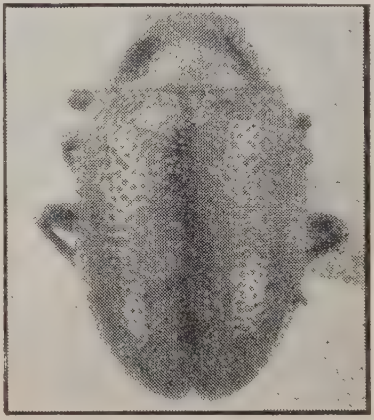
There are two types of fungus diseases: **Parasitic**—those growing on living plant tissue—and **saprophytic**—those living or resting on dead plant tissue.

The parasitic fungus is the main type with which orchardists are principally concerned, but this type often carries over from one season to another on dead plant tissue as a saprophyte. This emphasises the need for destroying all old plant refuse to avoid carry-over infection.

The parasitic fungi are divided into two general types: First, the ectoparasitic fungi, which live on the surface of the tissue of the host plants and the epidermal infection from which is very superficial in character—the mildews are typical examples. This type is controlled mainly by the many forms of sulphur. Second, the endoparasitic fungi, which live and feed within the plant tissue and often form fructifications on the surface—black spot, brown rot, and bitter rot are typical examples. Copper sulphate (a toxic soluble chemical) has been found the most effective material for the control of endoparasitic fungi, with sulphurs somewhat less effective.

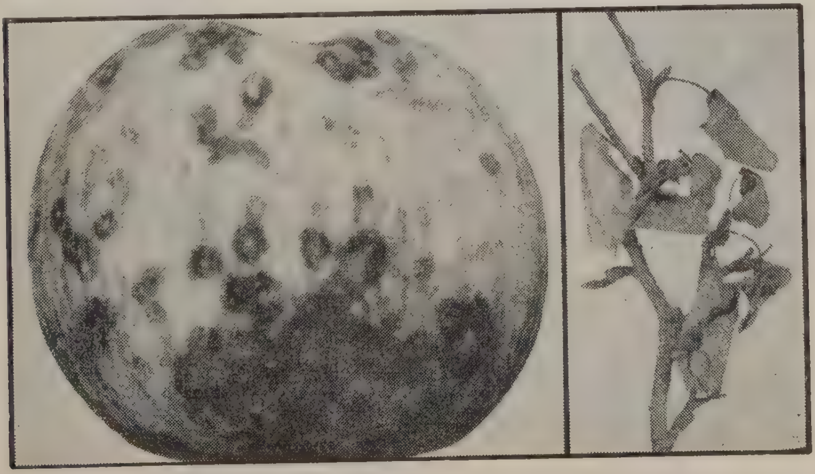
Bacterial Diseases

The infection element of the bacterial group of diseases consists of extremely minute organisms living within the plant tissue. Under suitable temperature and moisture conditions these organisms multiply rapidly and cause internal pressure and breakdown of tissue, resulting eventually in external canker formation or leaf and fruit blemish. Exudation through these cankers of re-infection organisms results in other healthy plants becoming affected. Transmission is carried out chiefly by sucking and other insects, including bees in some instances.



[*S. Rumsey photo.*

Bronze beetle (*Eucolaspis prunneus*), a chewing insect.

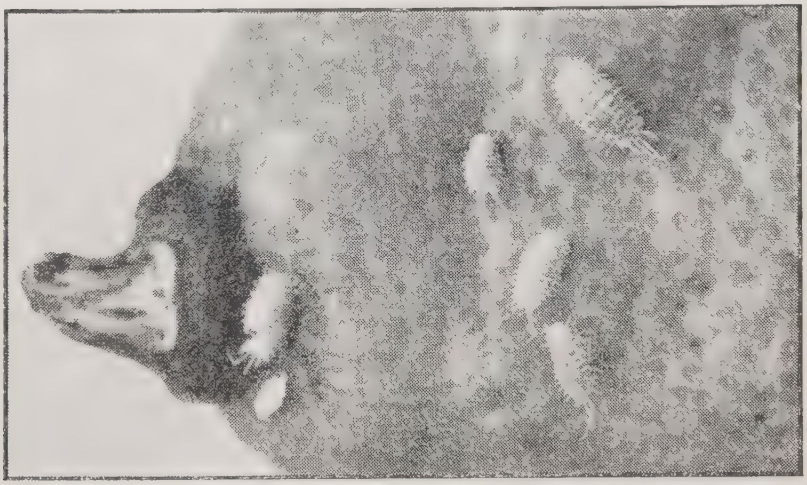


[*Photo at right by L. Wright.*

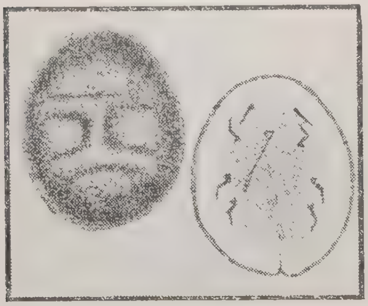
San Jose scale (*Aspidiotus perniciosus*), a piercing-sucking insect, on apple fruit and twigs. The illustration at right shows how dead leaves cling to affected twigs in winter after other leaves have fallen.

As the initial infection is usually caused within the plant tissue, spraying with fungicides has not proved entirely satisfactory, though this is still the subject of further investigation. So far the principal means of control is the cutting out and burning of all infected parts. In the case of severe infection the whole plant or tree should be destroyed. Fireblight and citrus canker are good examples of the bacterial group. In many respects bacterial diseases are similar in their general habits to the fungus group, except for their manner of growth and reproduction. Bacteria reproduce by

PESTS AND DISEASES OF FRUIT TREES



Mealy bugs (*Pseudococcus adonidum*), piercing-sucking insects, infesting a lemon.



[*After drawing by W. Cottier.*

The olive scale (*Saissetia oleae*), a common piercing-sucking type of insect, which affects many host trees and plants.

a process of rapid cell division, whereas with fungus a process of spore germination occurs.

Virus Diseases

In recent years knowledge of virus diseases has become more extensive and it has been found that they have a very wide host-plant range and a considerable variety of identification symptoms.

Virus diseases are difficult to define compared with other types. The infection organism is so minute that it was only in recent times that it was possible to see the organism with specially developed, high-powered microscopes.

Olive scale on lemon twig.

The infection lives within the plant tissue and the proof of a disease being of the virus type consists of its being reproduced on a healthy plant by the transference of infected sap or juices and observing the results. It is only quite recently that viruses have been found to be affecting fruit trees in New Zealand, but they are very common among annual plants. Examples of the disease are stony pit of pear fruits, apple leaf virus, streaking of tulips, and mosaic of tomatoes. In nearly all cases there is evidence of a mottling or streaking of foliage and stems, a general dwarfing or retardation of growth, or distortion of plant cells.

Spraying is only partially effective where the sucking insect carrier, such as the aphis, can be controlled. As in many instances infection is transmitted by mechanical or human contact, the main control is the severe rogueing and destroying of infected plants, the destruction of host weeds, and propagation from virus-free seed, plants, or fruit tree material.

Physiological Diseases

Physiological diseases or disorders are distinct in that no definite organism is responsible for the condition, evidence of which is a breaking down, distortion, hardening, or softening of plant tissue, generally resulting from cell collapse. This interferes with the healthy progress of plant or tree development. The actual causes are often unknown and, despite considerable research, control has been found difficult and limited in its scope. Examples of these diseases are bitter pit, glassy core, Gravenstein strangulation, and flesh collapse.

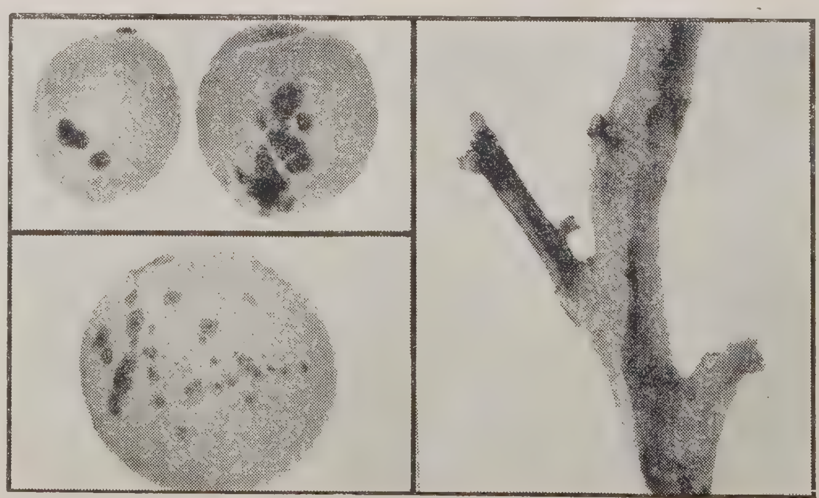
Deficiency Diseases

Deficiency diseases, too, are not pathogenic diseases, but are typical disorders generally indicated by chlorosis or mottling of the foliage resulting in a form of debility in trees or plants. Frequently, breakdown, dwarfing, and multiple discoloration of the foliage are evident. These disorders are caused by some soil element deficiency, often arising from an incorrect balance of the essential soil nutrients. Control can usually be achieved by applying the deficient element to the soil or in some cases by applying sprays containing the deficient element, which the plant absorbs through its leaves. For instance, high pH value in the soil will induce a manganese deficiency and this can be corrected by reducing the pH value by the application of suitable materials to the soil.

Controlling Diseases and Pests

The following is a list of the various methods by which the control of pests and diseases is effected:—

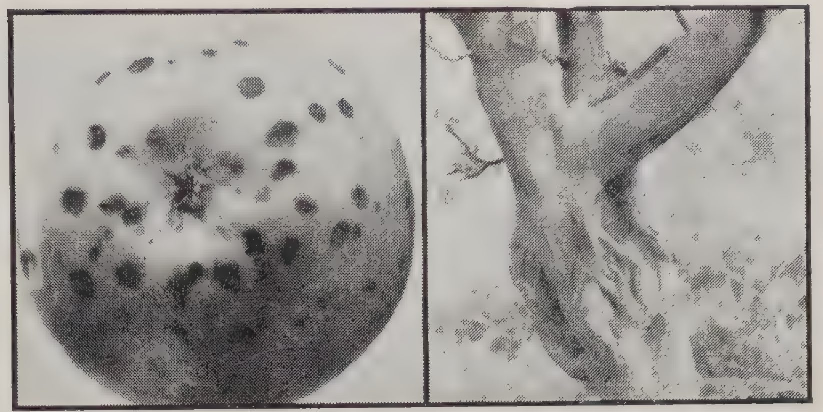
1. Spraying with chemicals—lead arsenate, lime sulphur, oils, etc.
2. The application of toxic dusting powders—derris, D.D.T., calcium, arsenate, etc.
3. Biological (parasitic or predacious insects—*Aphelinus mali*, etc.).



[*Photos of fruit by L. Wright.*

Bacterial diseases. Upper left—Bacterial spot of plum (*Xanthomonas pruni*); fruits show typical injury. Lower left—Citrus canker (*Pseudomas citri*) on a grapefruit. The illustration shows the typical infection spots and haloes round them. Right—Fireblight (*Bacillus amylovorus*) canker on pear branch.

PESTS AND DISEASES OF FRUIT TREES



[*Photos by E. B. Levy (left) and W. Barnard (right).*

Physiological diseases. Left—Bitter pit on an apple; the disease is in an advanced stage. Right—Strangulation, a form of cell collapse and gnarling, on a Gravenstein apple tree the wood of which is severely affected.

4. Raising and planting disease-resistant and insect-resistant varieties—Northern Spy apple stocks, Keiffer pears, etc.

5. Planting of disease-free and insect-free trees or plants—clean nursery stock.

6. Maintaining a satisfactory condition of the soil—attention to drainage, humus content, lime, and cultivation.

7. Prevention of overcrowding of trees and plants. It is necessary to provide ample room for normal development and access to plenty of air and light.

8. The provision of suitable shelter, but not excess, which causes restriction of air movement. Excess shelter promotes a stagnant atmosphere, which favours some fungus diseases and sun scald.

9. Preventing or protecting trees or plants from unnecessary injuries, which often result in infections of silver leaf, gummosis, *Polyporus versicolor*, etc. Careful sealing of large cuts is a further safeguard.

10. General sanitation or orchard hygiene, such as weed control, the removal of refuse, tree prunings, and decayed fruit, and the cleaning up of packing-shed surroundings and cases. This includes the prevention of carry-over infection by all possible means.

11. The scraping and banding of tree trunks to trap codling moth larvae.

12. Prevention of disease transmitted by insects. For instance, the control of aphis may prevent this insect acting as a vector in the transmission of virus.

13. The cutting out and destroying of infected parts of trees (eradication of trees in cases of serious infection), such as is often necessary for fireblight, silver leaf, and powdery mildew.

14. Co-operation among growers and by the public.

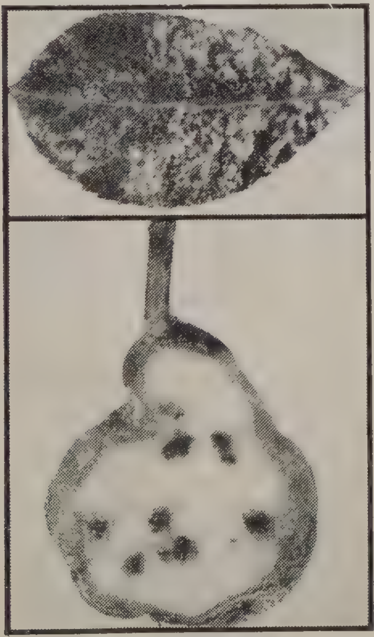
15. Control by birds—birds feed on aphides and other insects.

16. Maintaining healthy growth and vigour.

17. Legislation preventing introduction and spread of pests and diseases.

For annual crops and seeds there are additional methods of controlling diseases and pests, such as crop rotation, soil sterilising with steam, chemicals, and fumigants, gas chamber and glasshouse atmospheric fumigation, seed dusting, hot-water treatment of seed, plant dipping, and rogueing of plants infested by virus.

Detailed control measures are set out in the Department of Agriculture Bulletin No. 161, "Control of Orchard Diseases and Pests by Spraying," which can be obtained from the nearest office of the Department of Agriculture. Growers should also seek the guidance of the Orchard Instructor for the district.



[*L. Wright photos.*

Virus diseases. Upper—Apple mosaic, showing typical mottling on an affected Jonathan apple leaf. Lower—Stony pit, showing the internal lesions and general distortion in a Packham's Triumph pear.

INSECT PESTS COMMON TO FRUIT TREES IN NEW ZEALAND

Pests	Kind of fruit tree usually affected								
	Apple	Pear	Quince	Peach	Nectarine	Plum	Apricot	Cherry	Citrus
Chewing Insects									
Borer (various)	X	X	X	X	X	X	X	X	X
Bronze beetle (*Eucolaspis brunneus*)	X	X	X	X	X	X	X	X	
Codling moth (*Cydia pomonella*)	X	X	X						
Dicky rice weevil (*Maleuterpes spinipes*)									X
Grass-grub beetle (*Odontria zealandica*)	X	X	X	X	X	X	X	X	
Leaf-roller caterpillar (*Tortrix postvittana*)	X	X	X	X	X	X	X	X	X
Pear or cherry slug (*Caliroa limacina*)		X	X			X		X	
Sucking Insects									
Black aphis (*Rhophalosiphum nymphaeae*)						X	X		
Black aphis (*Anuraphis persicae-niger*)				X	X				
Black aphis (*Anuraphis schwartzi*)				X	X				
Circular black scale (*Chrysomphalia rossi*)									X
Cicada	X	X	X	X	X	X	X	X	X
Citrus aphis (*Aphis citricidus*)									X
Cottony cushion scale (*Icerya purchasi*)									X
Green aphis (*Myzus persicae*)				X	X	X	X	X	
Green apple aphis (*Aphis pomi*)	X	X							
Hemispherical scale (*Saissetia coffeae*)									X
Hard wax scale (*Ceroplastes sinensis*)									X
Katydid (*Caedicia olivacea*)									X
Leaf hopper (*Typhlocyba australia*)	X	X							
Mealy bug (*Pseudococcus maritimus*)	X	X							X
Mealy bug (*Pseudococcus adonidum*)									X
Mussel scale (*Lepidosaphes ulmi*)	X	X	X						
Olive scale (*Saissetia oleae*)									X
Oyster scale (*Diaspes santali*)	X	X							
Pear leaf blister mite (*Eriophyes pyri*)		X							
Pear midge (*Dasyneura pyri*)		X							
Red mite (*Paratetranychus pilosus*)	X	X		X	X	X	X		
Red mite (*Bryobia praetiosae*)	X	X		X	X	X	X		
Red mite (*Paratetranychus citri*)									X
Red scale (*Aonidiella aurantii*)									X
San Jose scale (*Aspidiotus perniciosus*)	X	X	X	X	X	X	X	X	
Soft wax scale (*Ceroplastes destructor*)									X
Thrips (*Heliothrips haemorrhoidalis*)									X
Woolly aphis (*Eriosoma lanigerum*)	X								

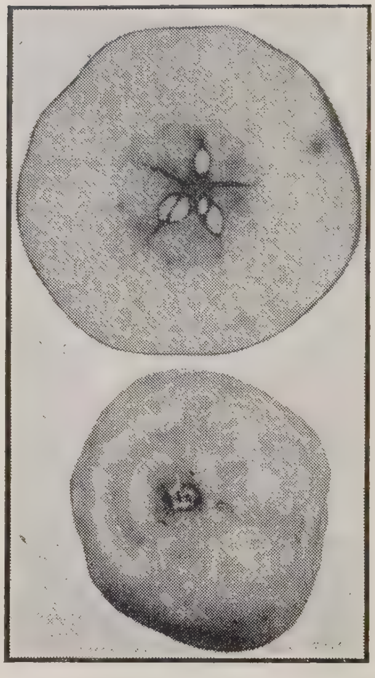
PESTS AND DISEASES OF FRUIT TREES

FUNGUS DISEASES COMMON TO FRUIT TREES IN NEW ZEALAND

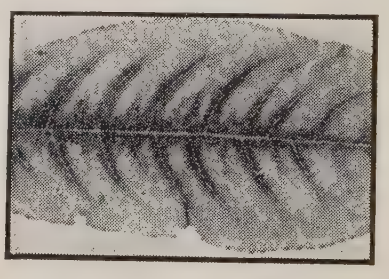
Fungus diseases	Kind of fruit tree or fruit usually affected								
	Apple	Pear	Quince	Peach	Nectarine	Plum	Apricot	Cherry	Citrus
Bark blotch (*Ascochyta corticola*)									X
Black spot (*Venturia inequalis*)	X								
Black spot (*Venturia pirina*)		X							
Black spot (*Physalospora cydoniae*)	X	X	X						
Bladder plum (*Taphrina pruni*)						X			
Bitter rot (*Glomerella cingulata*)	X	X	X						X
Blister disease (*Coniothecium chomatosporum*)	X	X							
Blue mould (*Penicillium italicum, P. expansum*)	X	X	X	X	X	X	X	X	X
Botrytis (*Botrytis cinerea*)	X	X	X	X	X	X	X	X	X
Brown rot (*Sclerotinia fructicola*)	X	X	X	X	X	X	X	X	X
Brown rot (*Phytophthora citrophthora*)									X
Collar rot (*Fusarium limonis*)									X
Coral spot (*Nectria cinnabarina*)	X	X	X	X	X	X	X	X	
Diplodia canker (*Diplodia griffoni*)	X								
Die back (*Clasterosporium carpophilum*)				X	X	X	X	X	
Fabraea scald (*Fabraea maculata*)		X	X						
Green mould (*Penicillium digitatum*)									X
Grey scab (*Gloeosporium limetticolum*)									X
Leaf curl (*Taphrina deformans*)				X	X		X		
Mouldy core (various fungi)	X								
Peach scab (*Cladosporium carpophilum*)				X	X				
Polyporus wood rot (*Polyporus versicolor*)	X	X	X						
Powdery mildew (*Podosphaera leucotricha*)	X		X						
Ripe spot (*Neofabraea malicorticis*)	X								
Root fungus (*Rosellinia radiciperda*)	X	X	X	X	X	X	X	X	
Root rot (*Armillaria mellea*)	X	X	X	X	X	X	X	X	X
Rust (*Puccinia pruni-spinosae*)				X	X	X	X	X	
Sclerotinia (*Sclerotinia sclerotiorum*)									X
Shell-bark (*Diaporthe citri*)									X
Melanose (*Phomopsis citri*)									X
Silver leaf (*Stereum purpureum*)	X	X	X	X	X	X	X	X	
Shot hole (*Phyllosticta prunicola*)				X	X	X	X	X	
Sooty mould (*Capnodium citricolum*)									X
Valsa injury (*Valsa leucostoma*)	X			X	X	X	X	X	
Verrucosis (*Elsinoe fawcetti*)									X
Wither tip (*Glomerella cingulata*)									X

BACTERIAL, VIRUS, PHYSIOLOGICAL, AND DEFICIENCY DISEASES COMMON TO FRUIT TREES IN NEW ZEALAND

Bacterial, virus, physiological, and deficiency diseases	Kind of fruit tree or fruit usually affected								
	Apple	Pear	Quince	Peach	Nectarine	Plum	Apricot	Cherry	Citrus
Bacterial diseases									
Bacterial spot (*Xanthomonas pruni*)				X		X			
Citrus blast (*Pseudomonas syringae*)									X
Citrus canker (*Pseudomonas citri*)									X
Fireblight (*Bacillus amylovorus*)	X	X	X						
Root knot (*Phytomonas tumefaciens*)	X	X	X	X	X	X	X	X	
Virus diseases									
Apple tree virus (mosaic)	X								
Stony pit		X							
Physiological diseases									
Apple pitting	X								
Bitter pit	X	X	X						
Flesh collapse	X								
Glassy core	X								
Gummosis				X	X	X	X	X	X
Gum spot									X
Gravenstein strangulation (gnarling)	X								
Oil spot (*Oleocelosis*)									X
Sour sap	X	X		X	X	X	X	X	
Split stone				X	X				
Deficiency disorders									
Various trace element deficiencies such as deficiency of:—									
Boron (for example, corky pit)	X								
Manganese	X		X	X	X	X			X
Magnesium	X								X
Zinc	X								X
Iron	X								X
Potash, etc.	X	X	X	X	X	X	X	X	X



Jonathan apple affected by internal cork, a deficiency disease due to lack of boron in the soil. It is common in apples in some districts.



[*L. Wright photo.*

A deficiency disease caused by lack of available manganese in the soil. This portion of peach leaf shows the typical dark green leaf veining against the light green to yellow background.

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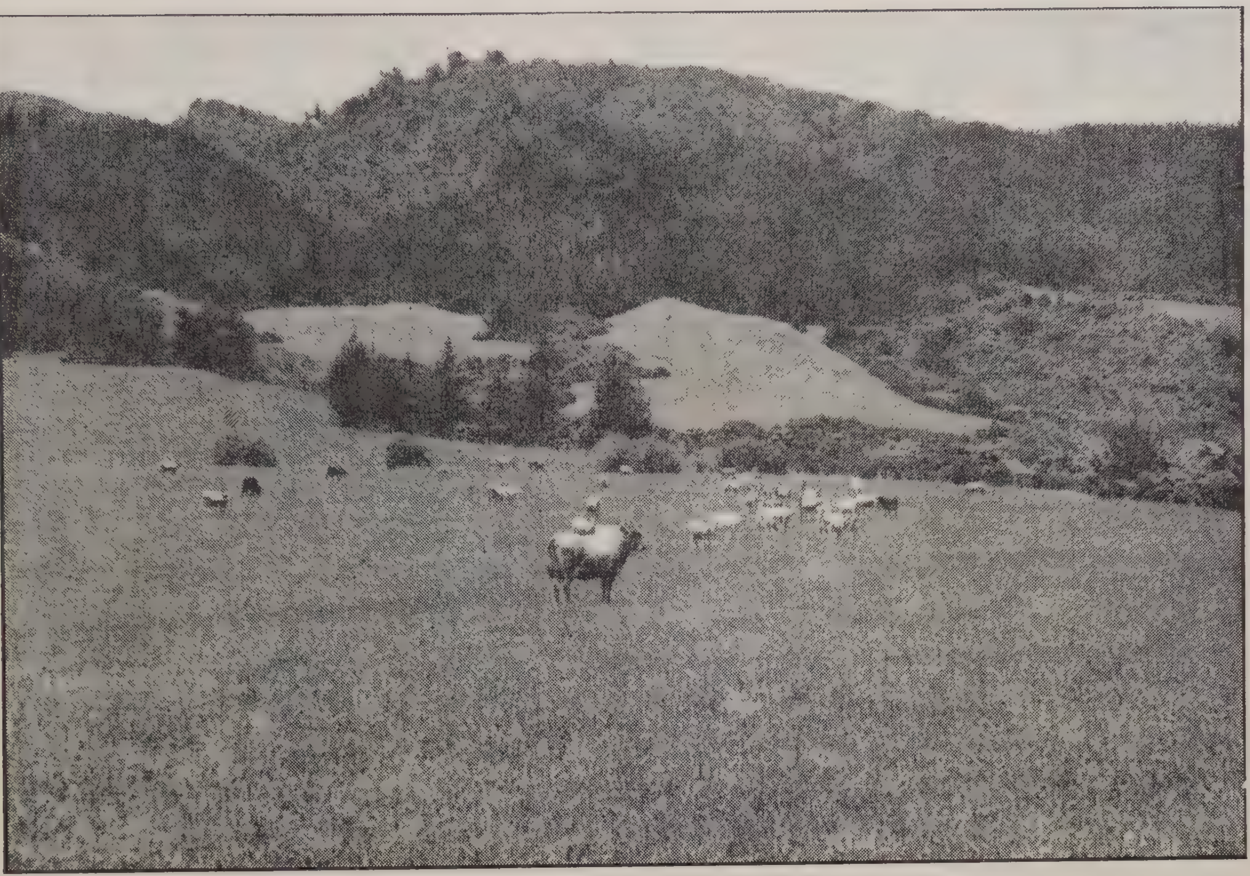
Acknowledgment

The author wishes to acknowledge the assistance given by officers of the Plant Diseases Division, Department of Scientific and Industrial Research.



Potash Topdressing in North Taranaki

By A. C. BURGESS and A. J. LYNCH, Instructors in Agriculture,
Department of Agriculture, New Plymouth.

THE importance of potash in plant life has long been recognised, but it is only in limited areas in New Zealand that less-than-sufficient potash occurs naturally in the soil, and attention has been focused on north Taranaki as one of these areas. Earlier work by officers of the Department of Agriculture demonstrated the value of potash in certain areas of north Taranaki, but from the results of extensive work carried out there recently the writers conclude that these soils are poverty stricken for potash generally. This finding is confirmed also by the results obtained by farmers in the district, high production invariably being associated with liberal applications of potash in addition to phosphate fertiliser.

POTASH is one of the most important elements in plant life and is necessary for the production of carbohydrates by plants. Clovers and other leguminous plants are potash lovers and in a pasture the main effect of potash is seen in an increase in the clover content. It is probable that the increased palatability of potash-topdressed pastures is in part due to this increase in clovers. Potash is taken up by plants chiefly in the early stages of active growth. Normally grass takes up about four times more potash than phosphate. Although much of the potash taken up by plants is returned by stock through their dung and urine, under intensive farming such as dairying or fat-lamb raising considerable quantities may be removed. It is estimated that on country producing 200lb. of butterfat per acre the equivalent of 11lb. of muriate of potash is removed annually per acre in the milk. Though most of this is returned in skimmed milk, little goes back on to grazing paddocks. Where sheep are grazed losses may be even higher. Assuming a carrying capacity of 4 ewes per acre, where lambs are fattened, the amount of potash taken off in flesh and wool each year is equivalent to 22lb. of muriate of potash per acre. Some potash is probably fixed in the soil and lost in drainage water, but according to New Zealand and overseas workers the amount is not great.

Some potash has been used for pasture topdressing in Taranaki for about 30 years. In the early 1930's observational topdressing trials laid down by the late J. M. Smith indicated that potash in addition to phosphate was often important in securing good pastures. McCulloch and Smith, writing in "The New Zealand Journal of Agriculture" in April, 1934, stated: "Whether the explanation is that there has always been a deficiency of potash as well as of phosphate in Northern Taranaki soils, or a recently created deficiency of potash mainly brought about as a result of unbalanced manuring—i.e., the use of phosphate only—over a lengthy period can only be conjecture, but the fact remains that in topdressing on a large number of farms in Taranaki today the use of potash is as important as that of phosphate."

The conclusion reached from the results of these trials led to 100 half-chain-square plots being laid down on farms in nearly all parts of north and central Taranaki. At the same time two more detailed grazing trials were carried out on the farms of Mr. F. Bracegirdle, Kaimata, and Mr. J. Shepherd, Tariki. On each farm one paddock was subdivided into two by the farmer, who, in addition to the usual phosphate or phosphate and lime topdressing over the whole paddock, topdressed one half with 2cwt.

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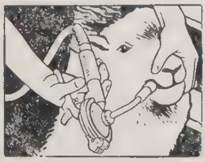

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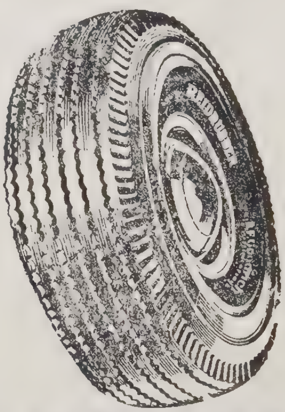

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per acre of 30 per cent. potash salts. The results of these two grazing trials were that on Mr. Bracegirdle's farm the average annual increase from 2cwt. per acre of 30 per cent. potash salts was 67.2 cow days per acre; on Mr. Shepherd's farm the average increase from the same dressings was 95.8 cow days per acre.

The results of the half-chain plot survey were variable. A general recommendation was made from them, but there remained areas where very poor responses were recorded, and, in the light of farmers' experiences in these areas later, the results obtained were very confusing. Many farmers using potash appeared to be obtaining outstanding results from it. If the results claimed were due to potash, it was necessary to prove this conclusively, as a great many farms, totalling a very large area, might be languishing for want of potash. On the other hand if, as was indicated by earlier work, some areas of country were less responsive to potash, by defining these areas much economy could be effected in the use of potash. From either point of view it was imperative that further clarification should be given to this aspect of pasture topdressing in north Taranaki, and a further survey was therefore begun in spring, 1947.

A convenient and accurate basis for the survey was provided by the identification of the different soil types existing in the area, for the defining of each soil type gives an accuracy to experimental work which it is impossible to achieve otherwise. Whereas without any soil classification experimental plots must be distributed throughout each district, or on the basis of a very general soil classification, the present definition of soil boundaries allows a more methodical distribution of experimental plots and a more accurate comparison to be made of all results, while a great saving in the number of trials to be laid down can be effected. Also any differences in responses to fertilisers within a soil type can now be attributed to farm management influences.

Soils of Taranaki

There are about 20 soil types in Taranaki, each differing in some respect from the others, but they are probably more alike in general characteristics than those of any other district, of the same area, in New Zealand. Apart from small areas of swamp, the soils of Taranaki fall into two main classes:—

1. Light, free-draining, volcanic loams, covering the country from the coast right round Mt. Egmont to the foothills in the east.

2. Papa and sandstone soils on the eastern hills and alluvial river-flat soils derived from papa and sandstone.

The volcanic soils are all derived from material erupted from Mt. Egmont, which in eruption from time to time has covered the whole district with a deep mantle of volcanic ash; in addition mud-flows have descended its western flank, covering the country between Opunake and Okato with rock debris, much of which is mounded, forming multitudes of conical or dome-shaped hills 10 to 40ft. high, with hummocky areas and swampy flats lying among them. The three main later ash showers which gave rise to the present soil are:—

1. The Egmont shower, which formerly covered the whole district, but which is now exposed only over a belt 4 to 10 miles wide, bordering the coast from Waitara to Hawera.

2. The Stratford shower, which overlies the Egmont shower in the eastern half of the district and extends from 4 miles south of Waitara to 3 miles north of Normanby.

3. The Burrell shower, which overlies the Stratford shower between Mt. Egmont and a point 3 miles west of Stratford. The Burrell shower was erupted probably less than 500 years ago.

The coastal soils derived from Egmont ash are divided into soil types according to the way they have been modified by vegetation growing on them and climatic conditions to which they have been subjected. The black coastal soils were covered in coastal scrub before the settlement of the land. Owing to different climatic conditions the black coastal soil north of New Plymouth (type 67A) is slightly different from that south of New Plymouth (type 66A).

Bordering on the black soils and extending inland, the brown soils derived from Egmont ash (soil types 67 and 67c) cover the area on which bush was growing before settlement. They are similar in most respects to the black soils and react similarly. The hummocky areas in the Warea and Rahotu districts are divided into two soil types 66c and 67c and are a mixture of Egmont ash and material from the mud-flow.

Soil type 67B, extending in a narrow band from Onaero through Lepperton to Upper Mangorei, represents the fine material from the Stratford shower, the bulk of which shower is represented by type 68. Soil types 69 and 70 are similar to 68, but have become more leached through being in higher rainfall belts. These soils are coarser in texture and lighter in nature than the coastal soils. The small lumps of pumice in the soil and subsoil are characteristic of this group.

These soils have been dealt with in detail because if there were any difference in manurial requirements of volcanic country of north Taranaki, it would occur between soil types or between regions of different rainfall.

Rainfall: Rainfall varies so considerably over the district that it is frequently suggested that soil requirements must vary accordingly. The average is about 50in. on the coast from Opunake to Okato, 60in. from Okato to New Plymouth, and probably 65in. or more north of New Plymouth. On the west side of Mt. Egmont the rainfall is successively higher as Egmont National Park is approached, until on the edge of the reserve it is about 100 to 120in. On the north side at the bushline about 150in. falls annually. The annual average from Koru through Egmont Village to Inglewood and Tariki is about 100in., which decreases gradually toward the east, being 80in. at Kaimata and about 75in. at Tarata.

There appears to be no correlation between rainfall and response to potash dressings, however.

Trial Plots Established

On the basis of the soil classification described a number of trials were laid down to demonstrate the value of potash in the district. The aim was to establish at least 3 trials on each soil type, and a methodical distribution of plots was thus obtained. It should be mentioned, however, that results are not yet available for two fairly extensive coastal areas. The areas are:—

1. The hummocky coastal soils from Warea south (66c and 67c);

2. The Glenn series (100B), which is characterised by impeded drainage and occurs in the Rahotu-Oaonui area.

The indications are, from results obtained by farmers in these areas and from soil analyses, that good results can be obtained there also.

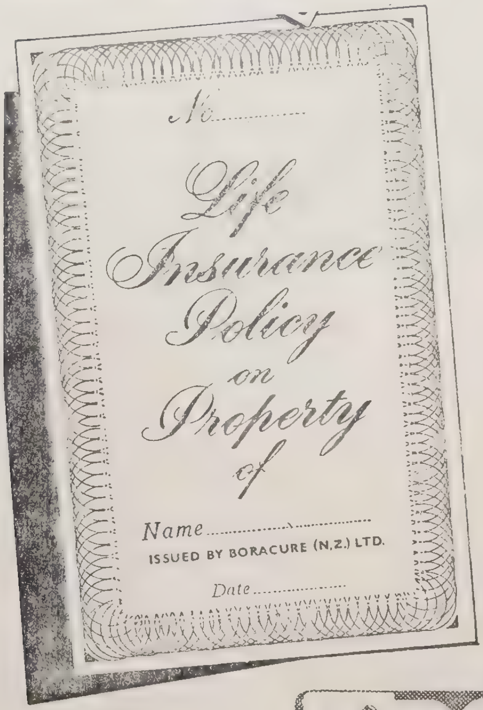
The plots were half a chain square and in most cases were duplicated in each field. Two types of potash were used: 30 per cent. potash salts at the rate of 2cwt. per acre in spring, 1947, and later, when the supply of this material became exhausted, muriate of potash (60 per cent.) at 1cwt. per acre. No comparison on these materials was attempted, but the effect of each was similar.

Where possible, paddocks selected to establish trials were normal grazing paddocks which had received ample phosphate dressings, but which previously had had little or no potash applied. Detailed records of previous topdressings were obtained and notes were taken on the pasture—its composition, vigour, and density. Soil samples were taken and analysed for potash content and inspections were made every 3 months and detailed notes again made on sward composition, etc.

Effects of Potash

Spectacular results were obtained on the majority of the trials. Of 38 trials established, in 25, all on volcanic soils, improvement was clearly visible in the composition and vigour of the sward from one dressing of potash. Five trials, giving poor results which were probably uneconomic, were on sandstone-papa country, which at present is not considered deficient in potash. Reasons advanced for the comparative failure of the remaining 8 trials, which were on volcanic soils, were that 1 trial was on a paddock which, unknown to its present owner, had received heavy potash dressings previously and had been used as a night paddock, while the remaining 7 were on poor pastures, and further work indicated that phosphate was the major deficiency and that potash alone was thus ineffective.

In all the trials similar changes were effected in the pasture, and are characteristic of potash topdressing. At first there is slight burning of the herbage, especially clover and flatweeds, and stock graze the area closely, probably because the salty taste of the potash appeals to them. The grass and clover species recover



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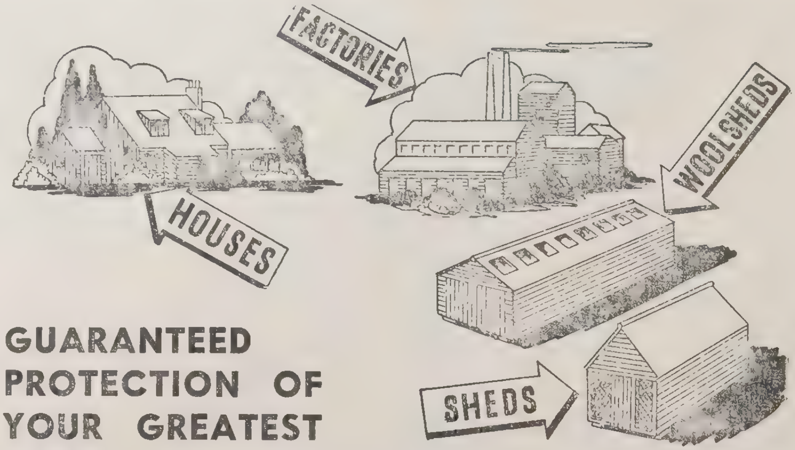

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Upper—Good dense clover growth in plot topdressed with potash. Lower—Same pasture outside plot, showing weedy and open growth with patchy clover.

quickly and are then stimulated by the topdressing to such an extent that they exert a weedicidal effect through smothering. The ability of grasses and clovers to smother out weeds species has always been the basis of weed control in Taranaki pastures, and this feature was outstanding where responses were obtained.

Increase in Clovers

The stimulation given to clover species by the increased fertility is remarkable and white clover is quick to respond, covering the ground in a dense mat. *Lotus major* and trefoil (suckling clover) are also encouraged by potash topdressing, but to a less extent than white clover, and it is the increase of the white clover which was so marked on the potash plots.

These two aspects, the encouragement of white clover and weed control, were watched with considerable interest, as they represent the two main problems in pasture management in north Taranaki. That one resolved itself into the other is abundantly clear when white clover can be seen filling up the bare spaces and stimulating the grasses to such aggressiveness that weeds play no major part in the sward.

Throughout the survey there was variation in the extent to which white clover responded. Though this was due mainly to the soil status at the time, grazing management also played its part. The following are typical of increases on pastures on which good responses were evident:—

District	Soil type	Clover content of pasture on "control," i.e., no potash area Per cent.	Clover content of pasture on potash area Per cent.
Tataraimaka ..	66A	10	25
Okato	67	20	30
Pukearuhe ..	67A	15	30
Lepperton ..	67B	20	30
Inglewood ..	68	20	30
Inglewood ..	69	10	30
Carrington Road	70	20	30

These analyses are from what might be termed average pastures throughout the district. The figures demonstrate:—

1. The serious lack of clovers in pastures being topdressed annually with phosphate only;

2. The marked increase (up to 200 per cent.) in clover content following potash application.

Recent work by Levy and Sears has demonstrated the extent to which clovers boost pasture production, and the necessity of maintaining a vigorous white clover in the sward need not be emphasised.

The pastures, after topdressing with potash, were much greener, the clovers had vigour and density, and the grass species were also growing vigorously and had lost any yellowed appearance typical of nitrogen starvation, which was evident before topdressing. It is the ability of potash to increase nitrification through white clover that makes it so valuable on these soils. The vigorous growth of the sward is maintained at all seasons, and the effects of drought in summer or cold weather in late autumn and winter are less noticeable on potash-topdressed pastures. The increased palatability of potash-topdressed pastures is very marked and is due probably to an increase in the clover content as well as increased palatability of the pasture species themselves, which results in more even grazing of the sward and less seed head in summer. Often farmers who have experienced the difficulty of getting stock to graze a certain paddock unless forced to have found that a liberal dressing of potash will result in the cows eating that grass with relish.

Effect of Management

Though the foregoing remarks apply to potash topdressing in general, it must not be assumed that they have universal application. Management obviously exerts a considerable influence on the condition of the soil and determines largely the extent to which potash topdressing is payable.

Night Paddocks

According to Hancock, Ruakura, a cow consumes 40 per cent. of her feed (if available) at night and voids 40 per cent. of her dung and urine at that time. Where the dung and urine are concentrated on one or two night paddocks it is obvious that there will be an accumulation of fertilising materials and humus in night paddocks. As the urine is high in potash, night paddocks are probably adequately supplied, so that when potash is applied the other paddocks should receive attention first. As humus carried by the stock is irreplaceable, the correct approach to this problem should be to extend the area used for night paddocks, if all paddocks cannot be used, up to 40 per cent. of the area of the farm. In this way there would be little transfer of fertiliser materials

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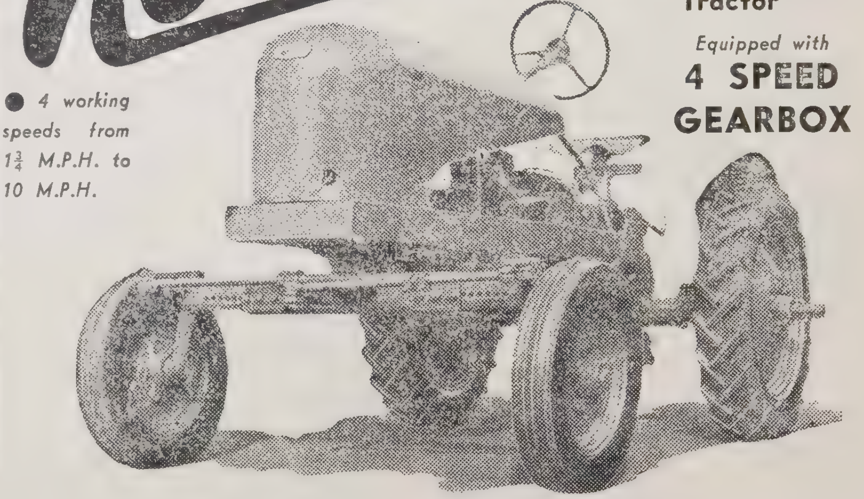

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and humus, and stock would be more likely to be adequately fed at night.

Hay and Silage Paddocks

A crop of silage or hay represents from a third to a half of the season's growth and when fed off in another field considerable quantities of fertilising materials are carried with it. Even when the crop is fed out on the paddock from which it is cut the cycle of fertility from grass to dung and urine and back to grass, which has been shown by Levy and Sears to be so valuable in high pasture production, is broken and the pasture does not receive nearly as much natural fertiliser, so that extra fertiliser should be applied to offset this deficiency. As it has been found in north Taranaki that potash is especially low in hay or silage paddocks, regular cutting of the same paddocks should be avoided if at all possible.

Use of Potash on Sheep Farms

It was mentioned earlier that on a sheep farm producing wool and fat lambs the loss of potash may be even higher than under dairying, and in this district the 3 trials established on sheep farms on volcanic soil all gave good responses when ample phosphate was applied also. It would appear, therefore, that a deficiency occurs under both types of management.

Phosphate or Potash

A common practice in north Taranaki as a substitute during the times of phosphate shortage was the use of potash and lime. The results were often misleading, as where good results were obtained many farmers assumed that this mixture was just as good as phosphate under any circumstances. However, good results with potash can be obtained only if the phosphate level in the soil is sufficient for the requirements of the pasture. The lime probably has little effect on the potash applied. Where lime and potash were used on soils where phosphate was very low very poor results were obtained.

The necessity for ample phosphate was proved on 3 trials where poor responses were obtained, as when the trial areas were oversown with 3cwt. of superphosphate per acre good responses were quickly observed with the phosphate alone, while the response where phosphate and potash were combined was better still. This was one of the most interesting features of the survey and possibly explains the variation in the results of the earlier survey carried out in 1934.

In other trials the responses obtained from potash varied with the amount of phosphate topdressing used previously—the more phosphate used the better the potash response obtained. This factor, from the results of the survey, appeared far more important than soil type. The claim can be made safely that all the volcanic soils of north Taranaki are potash deficient and that, provided the phosphate status of the soil is adequate, applications of potash will give payable results.

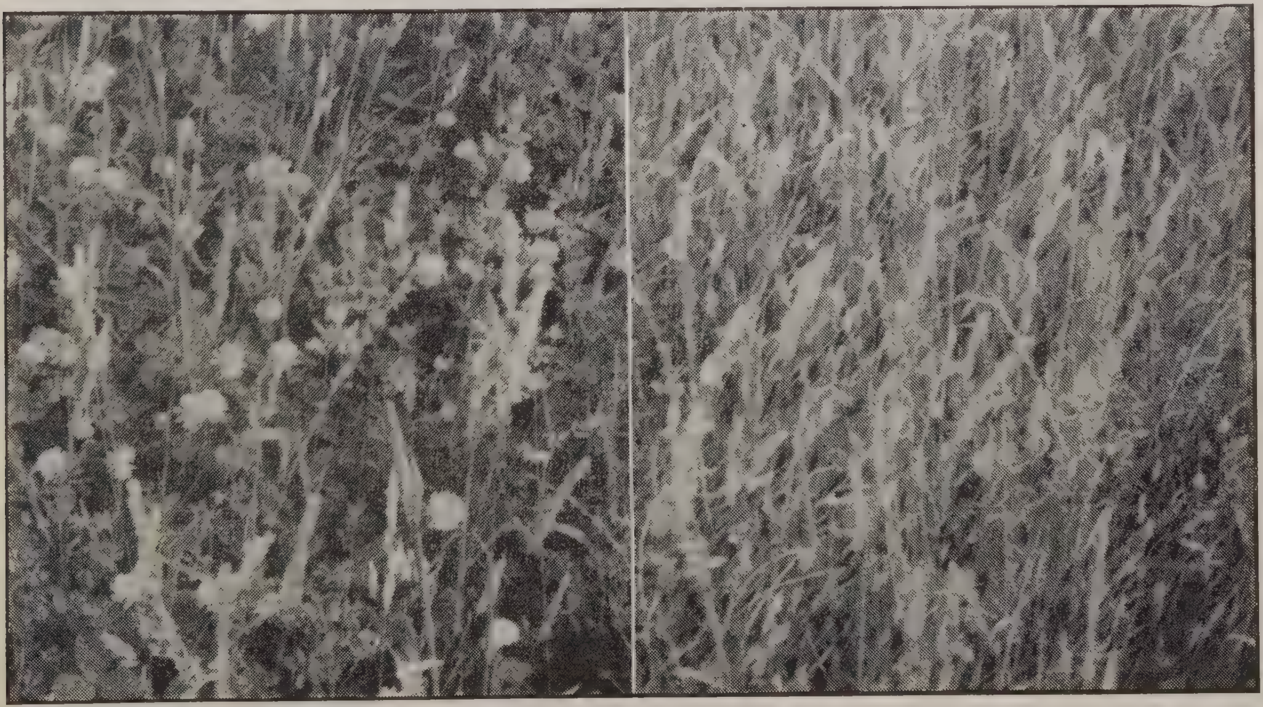
Soil Analysis

To confirm the results of the field trials and to check the value of soil analysis as a guide to topdressing practices approximately 80 samples of soil were taken from trial plots and from farms for analysis for potash content. The analysis confirmed that there was a general potash deficiency throughout the district and appeared generally to indicate a higher potash level than was apparent judging by the responses, but there was generally close correlation.

There were, however, some instances where soils with the same potash content differed considerably in responses and it can only be assumed that the phosphate level varied considerably. Since either phosphate or potash is likely to be a limiting factor to pasture production, an analysis would be required to show the level of each and possibly of lime if conclusions of real value are to be drawn. However, the knowledge that there is a general phosphate and potash deficiency in north Taranaki soils can often give a farmer a good guide to what is required if he knows the topdressing history of a field.

Trials of Application of Potash

Topdressing should be applied when it will give the greatest return and this is undoubtedly when the grass is growing and can use the fertiliser immediately it becomes available. In general, early-autumn or spring dressings give better returns than those applied in summer or winter. Autumn topdressing is preferable to spring topdressing because it enables grasses and clovers to grow better in late autumn, come away earlier in spring, and thus give the pasture the early start so necessary for high production.



Left—Dense growth of *Lotus major* and white clover with one dressing of potash on sward which had originally almost no clover. Right—The same pasture without potash.

POTASH TOPDRESSING . . .

Although no attempt was made in the present trials to compare the efficiency of potash applied at different times, numerous trials conducted by Elliott from 1934 to 1938 demonstrated clearly that the best times for applying potash were March or early April. August or September was the next best month for good results, while applications in May, June, July, or October gave much smaller responses, an important consideration with an expensive fertiliser such as potash, and farmers who wait until May or June before topdressing are probably losing a considerable part of the value obtained from this fertiliser.

Kinds and Quantities of Potash to Use

Before the Second World War over 80 per cent. of the potash fertilisers imported into New Zealand was in the form of 30 per cent. potash salts and this was used almost solely for pasture topdressing. The small quantities of muriate of potash imported were used mainly by orchardists and nurserymen. The 30 per cent. potash salts were mined in Germany and with the outbreak of war there was a cessation of supplies of this valuable fertiliser. An increased trade with Palestine, however, soon resulted in large quantities of muriate of potash being available, and since 1942 this has been the main form of potash used for pasture topdressing. The high prices prevailing have limited the use of potash to some extent, even where good responses have been assured. It has been proved, however, in this survey and in many previous trials that potash in addition to phosphate is necessary to produce really good pastures, and it is therefore poor economy not to use potash in reasonable quantities regularly for pasture topdressing in north Taranaki.

The quantity of 30 per cent. potash salts recommended before the war was 2cwt. per acre. Trials carried out in north Taranaki showed that 2cwt. of 30 per cent. potash salts was markedly superior to 1cwt. but that 3cwt. was no better than 2cwt.

In the survey recently carried out 1cwt. per acre of 60 per cent. muriate of potash or 2cwt. per acre of 30 per cent. potash salts was used. Good responses were obtained with these amounts, but analysis of samples taken from plots showed that the potash level was still not high. A number of samples taken from a farm where heavy annual topdressing with potash had been carried out showed that an average dressing of 90lb. of muriate of potash for the past 4 years had resulted in the soil still being only "medium" in potash, which would indicate that fairly heavy potash dressings would still be payable. On another farm dressings of 1cwt. per acre had been applied for the past 2 seasons and the analysis again showed only a medium potash content.

These results lead to the question, "If such heavy dressings are necessary, are the small amounts (3.5 per cent.–10 per cent.) of potash that are used in proprietary mixtures of any value?" Further trials will be established this year to get more information on this point, but evidence available at present points to the fact that such small quantities are not of any great value. A trial is in progress in north Taranaki at present in which various phosphates are compared with a mixture of 3cwt. of superphosphate and 1cwt. of potash (60 per cent.). Included in the treatments is a proprietary mixture containing 10 per cent. of muriate of potash and which, when the experiment was laid down, was £3 per ton more than superphosphate. Over 2 years there has been no visible difference between the plot treated with this mixture and those treated with superphosphate or serpentine superphosphate. In comparison the superphosphate and potash plot is outstanding.

The amount of potash in any mixture appears to be influenced by the price charged by other firms for their mixtures rather than by the amount known to be necessary for good results. The argument is put forward that a mixture containing too much potash is too dear, but surely the really dear mixture is the one in which a high-priced fertiliser is included in such small quantity that it has no value.

From all the results of the trials a dressing of 3 to 4cwt. of superphosphate or serpentine superphosphate together with 1cwt. of muriate of potash per acre is recommended as a suitable mixture for all of north Taranaki. The recommendation at present is that these amounts, at least, should be used if potash had not previously been used on the farm, to be followed by dressings of at least ½cwt. of muriate of potash per acre.

Summarising the position it can be stated:—

1. That there is a potash deficiency on all soil types in north Taranaki.
2. That good potash responses will be obtained only if phosphate is amply supplied.
3. That the potash level in the soil depends to a marked extent on the management to which a pasture has been subjected. Points are:—
   - (a) Hay and silage paddocks are usually most deficient in potash.
   - (b) Night paddocks are usually fairly well supplied with potash.
   - (c) Under sheep management there may be an even heavier drain on potash than under dairying, and good responses can be expected from potash on volcanic soil of the district.
4. The best time to apply potash is March-April or August-September.
5. The quantity recommended is 1cwt. per acre of 60 per cent. muriate of potash if potash has not been used before, followed by at least ½cwt. per acre annually. It is considered that the small quantities included in proprietary mixtures are too small to be of any appreciable value.

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METEOROLOGICAL RECORDS FOR DECEMBER

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	63.4	+ 1.4	80.2	41.0	2.62	7		1.39	27	231.9
Auckland	160	66.2	+ 2.8	79.4	51.1	2.78	9	— 0.35	0.95	16	233.0
Tauranga	10	65.1	+ 3.1	79.8	49.1	2.39	12	— 1.26	0.92	28	246.0
Ruakura	131	62.2	+ 0.8	81.3	38.2	1.73	8	— 1.45	0.74	16	238.3
Rotorua	980	62.8	+ 2.8	81.3	41.4	5.39	9	+ 1.60	1.89	31	215.4
Gisborne	12	65.6	+ 2.4	89.6	44.6	0.99	7	— 0.94	0.35	29	225.0
New Plymouth ..	160	60.8	+ 0.7	72.4	45.1	9.27	14	+ 4.84	4.75	24	229.5
Napier	5	65.2	+ 2.1	83.5	47.8	1.52	9	— 0.53	0.60	24	241.8
Taihape	2157	58.8	+ 2.5	78.8	40.4	3.19	14	— 0.08	0.92	24	
Wanganui	72	62.6	+ 1.5	79.9	47.1	4.46	14	+ 1.70	1.46	24	221.6
Palmerston North .	110	61.6	+ 1.2	78.5	44.6	4.54	15	+ 1.38	0.95	16	202.9
Waingawa	350	60.9	+ 0.9	85.0	38.0	4.16	14	+ 1.52	1.99	24	217.4
Wellington	415	58.8	— 0.2	75.4	46.0	6.18	11	+ 2.89	1.61	23	232.9
Nelson	24	62.4	+ 1.6	79.1	47.2	5.38	12	+ 2.37	1.61	28	257.0
Blenheim	12	62.2	+ 1.0	86.7	43.3	3.96	9	+ 2.26	1.13	28	280.2
Hokitika	12	55.8	— 0.2	72.6	39.6	13.10	15	+ 2.86	3.01	27	218.3
Hanmer Springs ..	1225	58.0	+ 0.2	88.0	33.5	5.68	13	+ 1.80	1.67	23	201.6
Christchurch ..	22	59.0	— 0.8	88.7	41.5	3.82	9	+ 1.33	1.48	1	215.1
Ashburton	323	58.4	— 0.2	89.4	34.8	4.44	10	+ 1.47	2.25	28	207.3
Timaru	56				38.0	2.60	9	— 0.02	0.73	28	200.9
Alexandra	520	60.2	— 0.2	91.9	37.8	1.19	9	— 0.19	0.28	23	260.4
Taieri	80	56.7	+ 0.7	87.2	34.8	1.71	14	— 1.03	0.49	27	242.9
Invercargill ..	32	56.0	+ 0.9	79.5	37.0	4.01	19	+ 0.36	0.55	6	210.4

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POISONOUS PLANTS IN NEW ZEALAND

THIS is the fifth section of a series of descriptions of poisonous plants which grow in New Zealand by H. E. Connor, Botanist, Department of Scientific and Industrial Research, Wellington. Glossaries to be used with the series were published with the first section, which appeared in the October "Journal".

DICOTYLEDONS

Rosaceae

Cherry Laurel. *Prunus laurocerasus* **L. (Fig. 9)**

Botanical description: Habit—Evergreen bush, seldom a small tree, widely variable. **Leaves**—Usually remotely small-toothed, 3 to 6in. long, and obtuse. **Flowers**—In slender racemes which scarcely exceed the leaves, highly scented and white. **Fruit**—Drupe, conic, pointed, about ½in. long, and purple-black. (Eastern countries.)

Habitat and distribution: Cultivated as a hedge plant.

General: Cherry laurel causes little trouble as a stock poison plant in New Zealand and losses should be infrequent if proper care is taken of hedges. In Central Otago calves have died after eating cherry laurel that had been left available to them. Losses of sheep and cattle have occurred in Europe. Special care should be taken in the disposal of hedge clippings of this plant because of the habit stock have of eating plants thrown over fences. Cherry laurel is not especially palatable to stock.

Symptoms of poisoning: Symptoms are acute. The animal goes down and struggles convulsively, death ensuing quickly. Irritation of the gut is visible on post-mortem examination.

Poisonous principle: Hydrocyanic acid is liberated from a cyanogenetic glycoside when in the presence of the necessary enzyme. An essential oil also present in the plant causes the irritation in the gut.

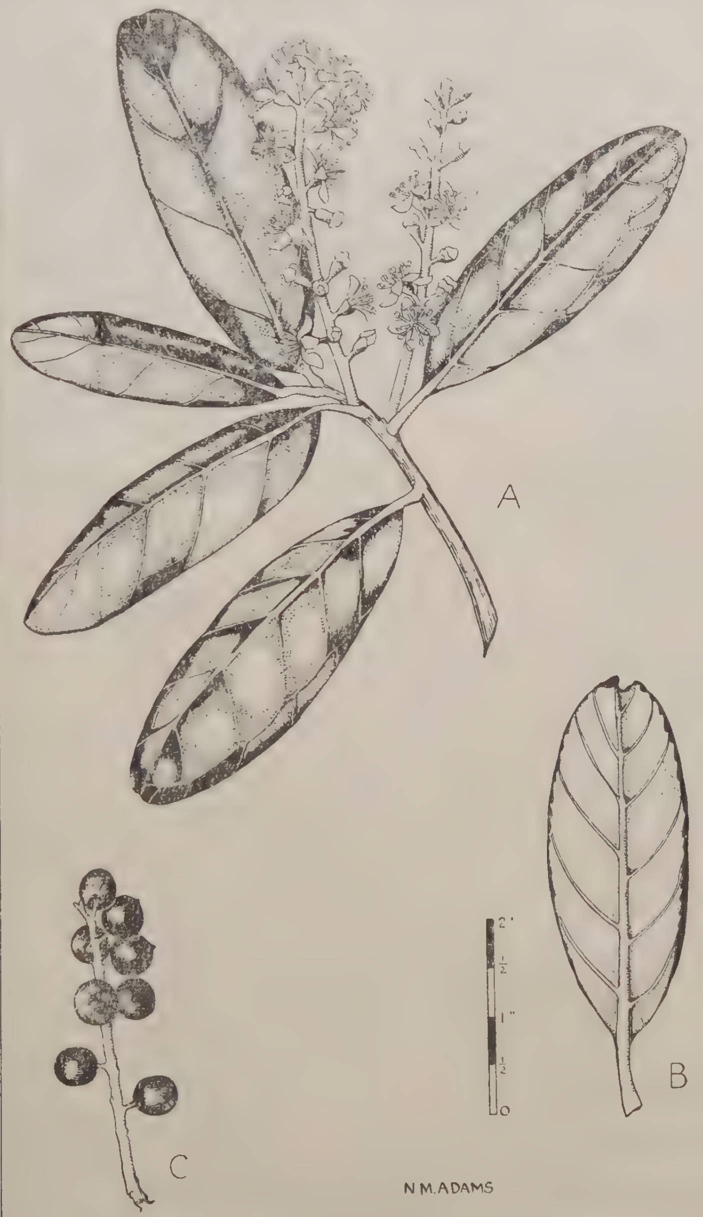

Fig. 9—Cherry laurel (*Prunus laurocerasus*). A: Habit. B: Leaf. C: Drupes.

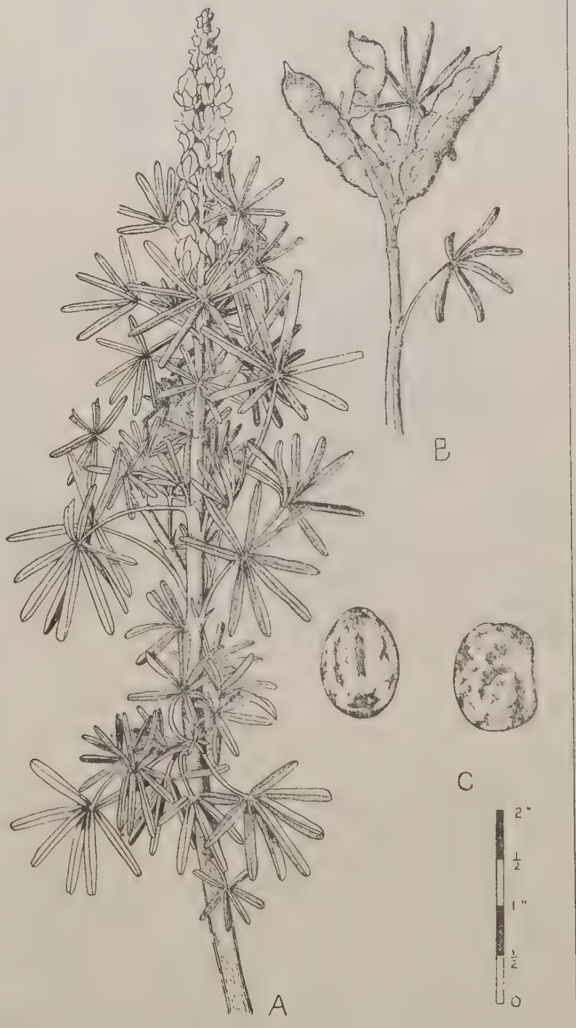

Fig. 10—Blue lupin (*Lupinus angustifolius*). A: Habit. B: Pods. C: Seeds, 5 times natural size.

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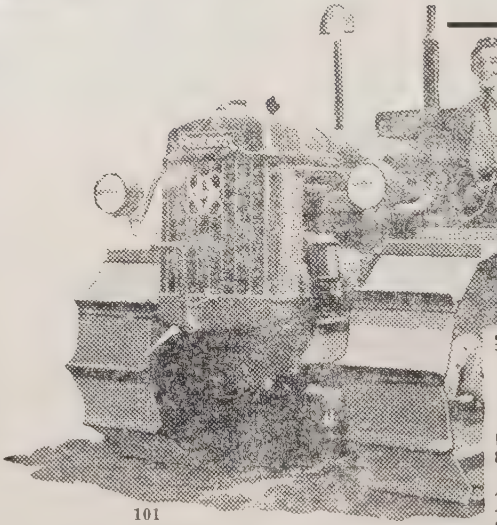

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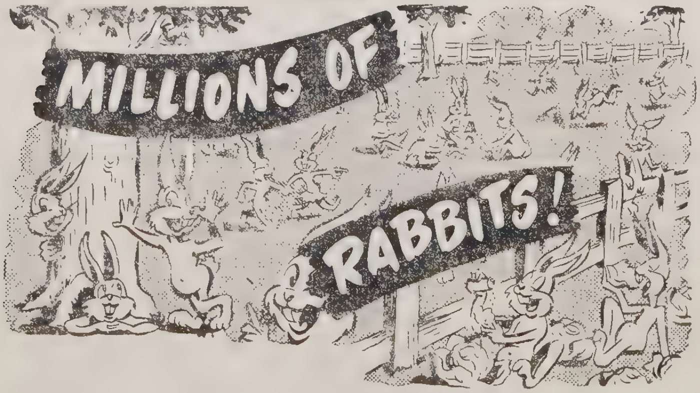

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Papilionaceae

Blue Lupin. *Lupinus angustifolius* **L. (Fig. 10)**

Botanical description: Habit—Annual herb up to 3ft. tall. **Leaves**—Digitate; leaflets 5 to 9, linear-oblong and covered with soft, appressed hairs. **Flowers**—Alternate, shortly pedicelled; corolla blue. **Fruit**—A villous pod with up to 6 seeds. (Mediterranean regions.)

Habitat and distribution: Cultivated plant.

General: Blue lupin is grown as a fodder and green-manure plant in the South Island and less frequently in the North. Occasional losses of sheep which have been poisoned by eating blue lupin are reported, the resulting disease being known as lupinosis, which is relatively common among sheep in parts of the United States of America. The time of feeding of the plant probably influences the occurrence of poisonings, and farmers have their own opinions about the stage of growth at which feeding should take place. The green pods and their seeds are the most toxic parts of the plant. The ripe seeds are also toxic, and in recent cases of poisoning the seeds were held responsible. The toxin is not cumulative and no deaths will result unless lethal quantities are eaten. New agricultural forms of lupin have been produced which are comparatively free from alkaloids; for example, sweet blue lupin.

Symptoms of poisoning: Staggers is a condition reported to be associated with lupinosis. Dopiness and depression are also shown. General icterus, yellow staining of visceral and subcutaneous fats, bright yellow liver, and gall bladder distended and showing catarrhal inflammation were recorded in New Zealand after post-mortem examination.

Poisonous principle: The alkaloid *d*-lupanine present in all parts of the plant is the most toxic of the lupin alkaloids.

Urticaceae

Ongaonga. Tree Nettle. *Urtica ferox* **Forst. f. (Fig. 11, A)**

Botanical description: Habit—Slender, much-branched shrub usually 2 to 5ft. tall; stinging hairs copious, long, rigid, and 1/6 to ¼in. long. **Leaves**—Blades 2 to 5in. long, narrow, ovate-triangular to lanceolate-triangular; margins deeply and coarsely toothed, the teeth ending in long, rigid bristles. **Flowers**—Unisexual, in axillary panicles 1 to 2in. long. **Fruit**—A small ovoid compressed nut. (New Zealand.)

Habitat: On fringes of and in bush.

Distribution: Not common except locally. Found as far south as Otago.

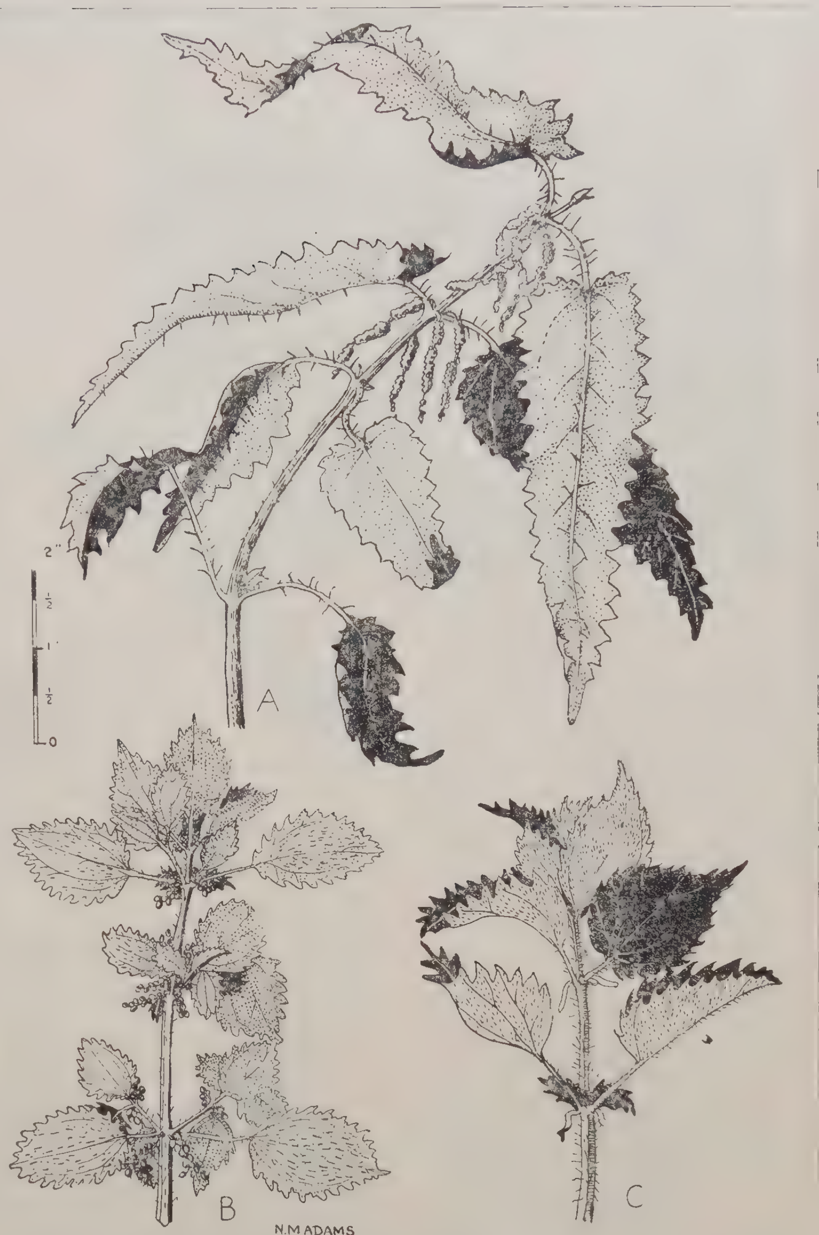

Fig. 11—A: Ongaonga (*Urtica ferox*). B: Nettle (*Urtica urens*). C: Stinging nettle (*Urtica dioica*).

General: Ongaonga is one of the poisonous plants classed as stingers. Animals which come into close contact with the stinging hairs of ongaonga suffer severe pain and may die. Horses and dogs are the only animals known to be affected, and horses are apparently the more susceptible, as they have been known to die quite soon after blundering into tree nettles. Three Home Guard horses died as a result of ongaonga poisoning in the Hutt Valley in 1944. Known losses are not frequent in the Dominion. A tramper reports that after tramping through nettle and then resting overnight he observed inco-ordination of movement in the morning. A "groggy" condition has also been reported by trampers who have made contact with ongaonga, this condition lasting up to 3 days.

Symptoms of poisoning: Intense pain is followed by convulsion and death in severe cases. In a dog loss of power of scenting was reported as a symptom. A maddened effect is produced.

Poisonous principle: The toxin in the stinging hairs is not known.

Urtica urens (Fig. 11, B) and *Urtica dioica* (Fig. 11, C) are two introduced nettles which have stinging hairs.

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Methods to Ensure Smooth Granulation of Honey

Seasonal Notes for the Domestic Beekeeper Contributed by the Horticulture Division.

HONEY is a food product depending for its popularity on its delicate natural flavour, general condition, and appearance. Beekeepers should exercise great care when handling a crop of honey, as it may be spoilt by the use of unclean utensils, the excessive use of strong-smelling fumigants to protect bee combs in storage against wax moth, or by excessive smoking of the bees and combs while the crop is being removed from the hives. Other causes of loss and waste include fermentation and also coarse grain, which makes any honey unattractive and quite unsuitable for ordinary table use.

NEW ZEALAND honeys are of variable composition, dependent upon the flowers from which the chief supply of nectar has been gathered. Honeys gathered even in small areas may be of different colours and flavours and have different reactions after removal from the bees.

In extracted honey production, honey is considered to be ripened and ready for removal from the hives when the combs have been fully capped over by the bees, but taking surplus crops in this state is the first step only in securing honey in good keeping condition and with a smooth grain suitable for table use.

Tendency to Granulate Varies

An important difference in honeys is their variation in tendency to granulate and the state of granulation whether fine or coarse. The first cause in variation in granulation is the difference in moisture content and other honey constituents.

The dextrose sugar in honey is the type which crystallises, not the levulose. A honey high in levulose, much above 40 per cent., and low in dextrose does not granulate readily under ordinary conditions.

Another factor in the granulation of honey is the presence of some fine dextrose crystals which serve as a starter for the formation of other crystals, leading to complete granulation. Where these crystals are destroyed by melting by the application of heat, further crystallisation may be delayed for months. Storage temperatures also affect the process of granulation. In general, granulation is favoured by storage at temperatures between 50 and 60 degrees F., with less granulation at storage temperatures above or below these figures.

There is no granulation at 10 degrees F., the honey apparently being so viscous that crystal formation cannot take place. On the other hand at temperatures above 75 degrees F. there is practically no granulation and none at 98 degrees F.

Honey has a definite tendency to segregate into liquid and crystallised layers because of its composition of sugars, which vary in weight and volume. This is evident especially when granulation is retarded by either warm temperatures or by high moisture content.

Fully capped combs ready for extracting.

Granulation Must be Rapid

To obtain an even, smooth grain in honey granulation must be rapid.

In some parts of New Zealand a dry atmosphere during the honey-flow period coupled with cool nights as the season progresses provide ideal conditions for quick granulation, and consequently it is not necessary for beekeepers to do more than clarify their honey, add a starter, mix it well, and pack the honey immediately. Other districts, however, are not so fortunate, as warm days and nights during the gathering, extracting, and storage periods prevent honey from granulating quickly with a smooth grain. In these circumstances the domestic beekeeper who has no facilities for holding honey at a low temperature for a few days in summer can do nothing about it as long as warm temperatures last. He can, however, store extracted honey in 5lb. or 10lb. tins and recondition any coarse-grained honey on hand in winter, making it in perfect condition for table use.

Most New Zealand honeys will respond readily to treatment after granulation if they are re-liquefied and a starter of smooth-grained honey thoroughly mixed in by the small beekeeper as follows:—

1. Place a 5lb. or 10lb. tin of coarse-grained honey (with the lid loosened) into a large pan of very hot water (not boiling) until the honey is all clear liquid. The water should not reach higher than 2 to 3in. from the top of the tin and may be kept hot by a gentle heat.
2. When the honey is clear liquid remove the tin and stand it in cold water until the temperature has dropped to about 75 degrees F.
3. Skim off any froth on top with a spoon and slowly stir in a quantity of smooth-grained honey (about 5 to 10 per cent. of starter) kept from the previous season or purchased for the purpose.
4. When a thorough mixing of the starter with liquid honey has been accomplished the honey should be sealed immediately and stored in a cool place until it has granulated to a firm consistency. In winter this usually takes from 4 to 6 days, according to the general condition of the honey when finally sealed and the coldness of night temperatures.

In these operations care must be taken not to get water into the honey. The pan holding the hot water in which the honey is stood should not be covered.

A little time spent in reconditioning any coarse-grained honey on hand along the lines indicated is well worth while.

LAMBING ESTIMATES FOR 1950

Dominion Percentage Second Highest on Record

Contributed by the Livestock Division.

THE estimated lambing percentage of the Dominion for the 1950 season of 95.64 per cent. is only .84 below that for 1949, which is the highest on record. As the percentage for 1949 was an appreciable increase of 3.37 per cent. on the previous highest figure of 93.11 per cent., which was recorded in 1947, the figure for 1950 is the second highest recorded.

The figures for both the North Island and the South Island are proportionate to the Dominion total in their relation to other years and are the second highest on record. The North Island percentage for 1950 was 94.04 compared with 94.55 in 1949. The best percentage before 1949 was 92.56 in 1945. The South Island percentage for 1950 was 97.65, while for 1949 it was 98.93 per cent., which was 2 per cent. higher than the previous best, 96.93 in 1948.

AUCKLAND DISTRICT

County	Breeding ewes (as at 1950)	Estimated percentage of lambs	Estimated number of lambs
Mangonui	29,063	80.10	23,279
Whangaroa	14,165	82.70	11,714
Bay of Islands	60,278	88.80	53,527
Hokianga	40,974	71.42	29,264
Whangarei	90,335	85.92	77,616
Otamatea	80,253	87.67	70,358
Hobson	78,849	88.41	69,710
Rodney	90,601	83.39	75,552
Great Barrier Island	5,920	62.28	3,687
Waitemata	72,283	86.97	62,865
Eden	3,117	81.79	2,549
Manukau	70,961	92.55	65,674
Franklin	140,084	94.66	132,604
Coromandel	30,767	75.40	23,198
Thames	13,153	87.02	11,446
Hauraki Plains	19,077	92.40	17,627
Ohinemuri	21,867	85.31	18,655
Waikato	171,554	98.71	169,341
Raglan	449,148	89.33	401,224
Waipa	184,277	102.70	189,252
Piako	136,508	100.61	137,341
Matamata	300,345	100.54	301,967
Rotorua	110,524	100.10	110,635
Taupo	18,437	89.31	16,466
Taumarunui	114,862	91.26	104,823
Kawhia	73,213	91.20	66,770
Otorohanga	154,411	96.00	148,235
Waitomo	381,165	90.12	343,506
Ohura	117,513	92.45	108,641
Katieke	65,293	88.75	57,948
Tauranga	149,069	92.20	137,442
Whakatane	51,030	95.00	48,479
Opotiki	46,469	73.00	33,922
Totals	3,385,565	92.31	3,125,317

EAST COAST-HAWKES BAY DISTRICT

County	Breeding ewes (as at 1950)	Estimated percentage of lambs	Estimated number of lambs
Matakaoa	63,450	82.00	52,029
Waiapu	236,283	82.20	194,225
Uawa	120,706	85.50	103,204
Cook	420,263	90.40	379,918
Waikohu	350,050	86.00	301,043
Wairoa	410,271	86.80	356,115
Hawkes Bay	929,391	97.27	904,019
Waipawa	451,405	100.85	455,242
Waipukurau	143,012	100.95	144,371
Patangata	504,202	92.83	468,051
Weber	54,820	85.23	46,723
Dannevirke	292,606	96.69	282,921
Woodville	88,221	100.20	88,397
Pahiatua	161,474	90.41	145,989
Akitio	151,318	80.90	122,416
Totals	4,377,472	92.40	4,044,663

WEST COAST-WELLINGTON DISTRICT

Clifton	92,653	91.27	84,564
Taranaki	29,295	99.69	29,204
Inglewood	53,022	92.24	48,907
Egmont	21,938	99.73	21,879
Stratford	113,281	93.38	105,782
Whangamomona	56,178	88.83	49,903
Eltham	55,255	96.07	53,083
Hawera	78,349	96.30	75,450
Waimate West	4,996	99.08	4,950
Patea	215,027	97.00	208,576
Waitotara	137,093	90.00	123,384
Waimarino	176,546	93.00	164,188
Wanganui	269,255	91.00	245,022
Rangitikei	974,058	102.00	993,539
Oroua	213,629	100.93	215,616
Kairanga	111,545	104.90	117,011
Kiwitea	248,269	100.81	250,280
Pohangina	132,897	100.36	133,375
Manawatu	147,574	105.40	155,543
Horowhenua	122,074	97.51	119,034
Hutt	67,564	78.35	52,936
Makara	45,601	86.87	39,614
Featherston	320,018	101.70	325,458
Wairarapa South	168,858	90.80	153,323
Masterton	292,858	90.40	264,744
Castlepoint	85,735	90.30	77,419
Eketahuna	136,837	97.60	133,553
Mauriceville	46,693	81.50	38,055
Totals	4,417,098	97.00	4,284,392

LAMBING ESTIMATES FOR 1950

MARLBOROUGH-NELSON-WESTLAND DISTRICT

County	Breeding ewes (as at 1950)	Estimated percentage of lambs	Estimated number of lambs
Waimea	163,842	79.0	129,435
Takaka	27,156	81.0	21,996
Collingwood ..	13,126	85.0	11,157
Buller	1,348	90.0	1,213
Inangahua	13,179	96.0	12,652
Murchison ..	27,673	81.0	22,415
Grey	24,580	108.0	26,546
Westland	32,055	113.0	36,222
Sounds	92,945	67.0	62,273
Marlborough ..	202,589	84.0	170,175
Awatere	167,776	89.0	149,321
Totals	766,269	83.97	643,405

CANTERBURY-KAIKOURA DISTRICT

Kaikoura	126,350	81.0	102,344
Amuri	217,387	86.0	186,953
Cheviot	150,183	94.0	141,172
Waipara	287,008	100.0	287,008
Ashley	64,280	101.3	65,116
Kowai	76,598	101.6	77,824
Oxford	67,907	86.0	58,400
Rangiora	47,242	112.0	52,911
Eyre	56,405	109.0	61,481
Tawera	50,565	79.0	39,946
Malvern	132,998	99.0	131,668
Paparua	35,125	106.0	37,233
Waimairi	2,794	101.0	2,822
Heathcote	6,936	97.0	6,728
Akaroa	82,605	108.0	89,213
Mount Herbert ..	38,359	103.0	39,510
Wairewa	67,849	101.0	68,527
Halswell	14,899	101.0	15,048
Springs	30,130	110.0	33,143
Ellesmere	75,179	115.0	86,456
Selwyn	140,266	77.5	108,706
Ashburton	780,784	92.4	721,444
Geraldine	261,603	98.0	256,371
Levels	186,612	109.0	203,407
Mackenzie	298,835	86.0	256,998
Waimate	487,624	90.6	441,787
Chatham Islands ..	45,318	73.0	33,082
Totals	3,831,841	94.09	3,605,298

OTAGO-SOUTHLAND DISTRICT

County	Breeding ewes (as at 1950)	Estimated percentage of lambs	Estimated number of lambs
Waitaki	449,279	91.0	408,844
Maniototo	226,278	91.0	205,913
Vincent	238,526	90.0	214,673
Waihemo	100,560	97.0	97,543
Waikouaiti	71,997	97.0	69,837
Taieri	171,256	89.0	152,418
Peninsula	15,362	104.0	15,976
Clutha	471,664	108.0	509,397
Tuapeka	353,291	97.0	342,692
Bruce	252,279	102.0	257,325
Lake	128,579	84.0	108,006
Southland	1,980,797	112.0	2,218,493
Wallace	639,282	97.0	620,104
Stewart Island ..	2,279	80.0	1,823
Totals	5,101,429	102.38	5,223,044

DISTRICT ESTIMATES

The following table gives the estimates of the current (1950) season's lambing for each sheep district:—

Auckland	3,385,565	92.31	3,125,317
East Coast-Hawkes Bay	4,377,472	92.40	4,044,663
West Coast-Wellington	4,417,098	97.00	4,284,392
Marlborough-Nelson-Westland ..	766,269	83.97	643,405
Canterbury-Kaikoura	3,831,841	94.09	3,605,298
Otago-Southland ..	5,101,429	102.38	5,223,044
Dominion ..	21,879,674	95.64	20,926,119

Dominion Totals

The following table shows the estimated lambing for the North and South Islands for the previous 5 years together with the actual number of lambs tailed:—

Year	Number of breeding ewes (*as at 1945)	Estimated percentage of lambs	Estimated number of lambs	Actual No. of lambs tailed
		NORTH ISLAND		
1950 ..	12,180,135	94.04	11,454,372	—
1949 ..	12,027,414	94.55	11,371,834	Not available
1948 ..	11,821,596	89.43	10,572,444	10,830,868
1947 ..	11,696,313	92.47	10,814,554	11,250,554
1946 ..	*11,890,011	87.92	10,453,719	10,447,857
1945 ..	11,890,011	92.56	11,004,903	11,252,679
		SOUTH ISLAND		
1950 ..	9,699,539	97.65	9,471,747	—
1949 ..	9,472,289	98.93	9,370,665	Not available
1948 ..	9,233,886	96.93	8,950,202	8,975,017
1947 ..	9,047,469	93.94	8,498,971	8,584,492
1946 ..	*8,975,847	91.69	8,229,713	8,194,441
1945 ..	8,975,847	92.75	8,324,990	8,308,779
		DOMINION		
1950 ..	21,879,674	95.64	20,926,119	—
1949 ..	21,499,703	96.48	20,742,499	Not available
1948 ..	21,055,482	92.72	19,522,646	19,805,885
1947 ..	20,743,782	93.11	19,313,525	19,835,046
1946 ..	*20,865,858	89.54	18,683,432	18,642,298
1945 ..	20,865,858	92.64	19,329,893	19,561,458

Young Farmer Leadership Competition in Sydney

NEW ZEALAND will again take part in the Young Farmer Leadership Competition, sponsored by the Australian Broadcasting Commission, at the Sydney Royal Easter Show. Young farmers from the United States, the Philippines, the Netherlands, Norway, Sweden, Canada, and Great Britain are also expected to compete.

In 1949 Gilbert Evans, Carterton, gained second place, and in 1950 Richard Harris, Gisborne, was beaten by one point.

Elimination contests are being held by the Y.F.C. district committees in New Zealand, and the four councils will each select a finalist in broadcast contests arranged by the New Zealand Broadcasting service.

The Dominion final will be broadcast from Station 2YA Wellington on March 7, at 7 p.m., over a national link.

Competitors must be under 21 years of age on March 25, 1951, and must be bona fide Y.F.C. members; they must answer, without script, questions on farm work, club activities, and community service. They will be judged on radio personality, farming knowledge, and leadership.

The New Zealand contestant will leave for Sydney on March 16, and with the other overseas competitors will be the guest of the A.B.C. for ten days during the visit.

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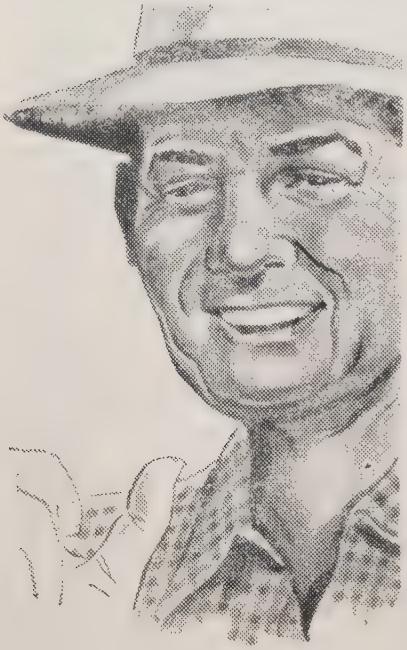

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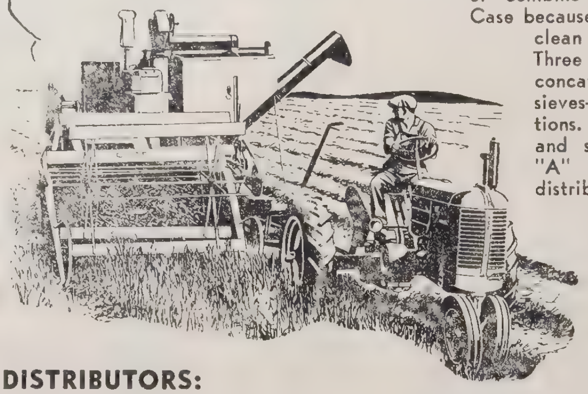

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Nutritional Deficiencies and Diseases of Poultry

An adequate and balanced diet keeps poultry healthy and sustains the birds' natural resistance to disease if management is good.

THE artificial conditions under which poultry flocks are reared and kept necessitates careful attention to the composition of a diet not only complete in proteins, carbohydrates, and fats, but also containing certain essential accessory food substances (vitamins and minerals). Extremely small amounts of these substances are required, but their absence or deficiency in the ration gives rise to fairly definite disease symptoms. In this article by J. J. Thompson, Veterinarian (Poultry), Department of Agriculture, Wellington, only the deficiencies likely to occur under ordinary New Zealand feeding conditions are discussed.

MODERN commercial poultry keepers in many cases favour the housing of poultry under intensive conditions which prevent the birds from correcting the lack of essential elements in the diet by grazing on pasture. This has led to considerable research into poultry nutrition to establish the complete requirements of chicks, growing stock, and laying and breeding birds. From this study has emerged a mass of scientific information which makes the subject of poultry nutrition and its effect on the health and productivity of the fowls very complex.

Fortunately, relatively little of this information need concern the poultry keeper. By emphasising the practical essentials to the exclusion of the remainder and reducing the scientific technicalities to simpler terms, stress is placed on the elements necessary in the normal diet. All the minerals and vitamins required for feeding poultry are contained in the foodstuffs in common use. Preparation of a balanced ration which will supply the necessary nutrients consists largely of making intelligent use of these foods in the proper proportions.

A good diet is one which keeps the bird healthy and sustains its natural resistance to disease if management is good. The unbalanced diet makes the flock more susceptible to diseases of bacterial origin, coccidiosis, worm parasites, and colds.

MINERALS

Numerous mineral elements are required by poultry. They enter into the composition of bone, the functions of the organs, and clotting of the blood, and are necessary for the maintenance of life and reproduction. The essential minerals are calcium, potassium, magnesium, phosphorus, zinc, chlorine, sodium, manganese, iodine, iron, copper, sulphur, and cobalt. The ordinary constituents of rations contain most of these elements in sufficient quantity. Calcium, phosphorus, sodium, chlorine, and manganese are the only minerals which require practical consideration. The feeding of minerals in excess may have harmful effects.

Calcium (Lime)

The important part played by calcium in the composition of bone and egg shell underlines the necessity for the inclusion of this mineral in the rations of both growing and laying stock. Deficiency of calcium in the diet of young stock leads to poor growth and rickets. In laying stock it causes poor egg-shell quality, lowered production, and poor hatchability.

Growing stock require 1 per cent. of calcium in the ration. To meet the needs of egg-shell production laying stock require a higher percentage, and the recommended amount is 2½ per cent. of the ration. This is usually supplied by adding up to 1 per cent. of ground limestone, shell grit, or oyster shell to the mash and supplying the remainder in troughs.

Confusion is sometimes encountered through the use of the term grit to cover two different substances. Soluble or shell grit such as oyster shell or limestone grit is used to supply the calcium requirement. Insoluble or hard grit is necessary if whole grain or coarse feed is supplied; it is stored in the gizzard and assists the grinding action of that organ in breaking down large food particles such as grain, leading to more efficient digestion of the food material. Granite chips or gravel are good types of hard grit and should be made available for laying birds to eat at will. For chicks coarse sand is useful.

Grains and their by-products—bran and pollard—have a poor calcium content; meat meal and fish meal contain a relatively high percentage. A large excess of lime in the diet affects hatchability adversely and may also cause digestive upsets.

Phosphorus

Phosphorus is also necessary for bone formation, and occasional cases of rickets are caused by deficiency. The close association of calcium and phosphorus in the formation of bone and in the body metabolism is well established and they are usually considered together.

The utilisation of both minerals depends on the presence of adequate vitamin D in the ration. If sufficient vitamin D is not present, calcium and phosphorus are not deposited normally in the bones of the chicks, leading to rickets.

Because of their close relationship a ratio between the two minerals has been laid down. This ratio is generally accepted at 1½ to 2 of calcium to 1 of phosphorus for growing birds. The higher requirement of calcium by laying birds because of shell production necessitates a higher ratio.

If a vegetable protein concentrate such as ground nut meal is fed, the inclusion of bone meal in the ration may be necessary. Meat meal, fish meal, bran, and pollard are good sources of phosphorus and rations in which these form a considerable part do not require any phosphorus supplement.

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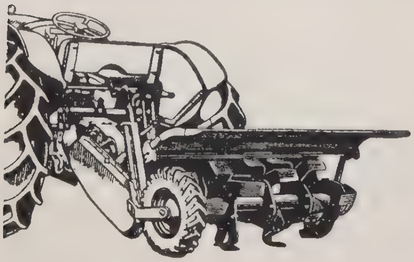

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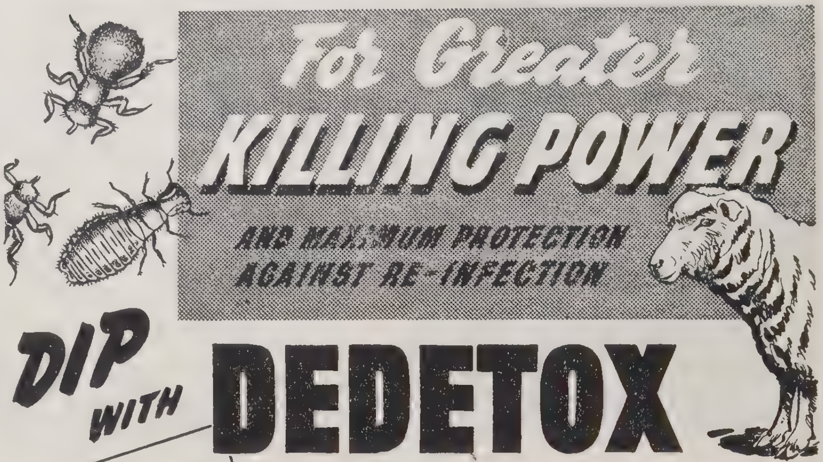
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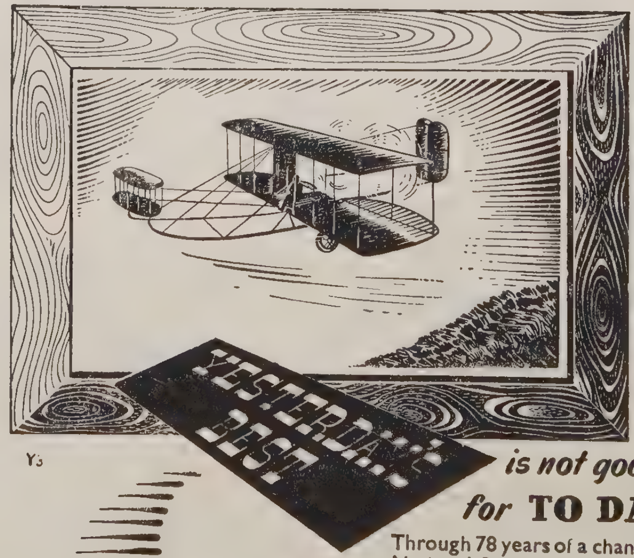

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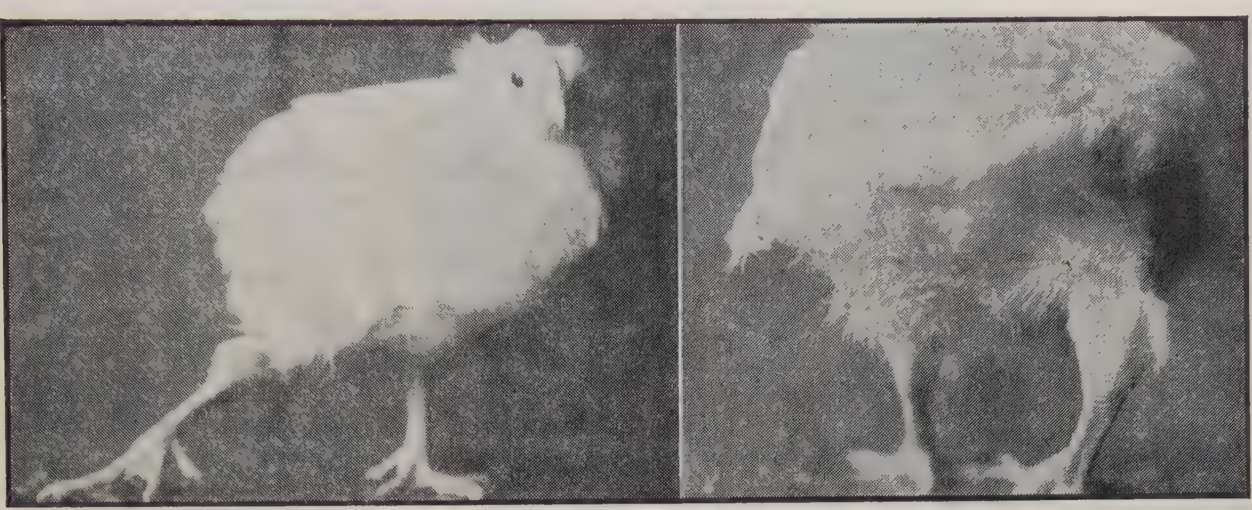


Chicks affected with perosis, or slipped tendon, a condition caused by a deficiency of manganese in the diet. The manganese shortage in the diet of these birds was a result of feeding excess phosphorus in the form of bone meal. The enlarged hock is caused by inflammation of the joint and displacement of the tendon, which slips out of the normal groove at the back of the hock joint.

Excess phosphorus feeding affects chick growth adversely because of calcium-phosphorus unbalance. The feeding of excess bone meal with its high phosphorus content, which "fixes" the manganese in the diet so that it is not available to the birds, may give rise to perosis (slipped tendon).

Salt (Sodium Chloride)

The addition of salt to the diet meets the requirements of poultry for both sodium and chlorine. Salt should be added to the mash at the rate of ½ per cent. for an all-mash ration or 1 per cent. for a mash-grain ration. If fish meal forms a high proportion of the protein supplement, the addition of salt to the mash is unnecessary.

Contrary to popular belief, poultry tolerate salt in the feed reasonably well and up to 8 per cent. has been fed to growing chickens without harmful effects. Nevertheless, care must be taken that the salt is well distributed in the mash.

Deficiency of salt causes slow growth and lowered egg yield and may initiate an outbreak of feather picking and cannibalism. Increasing the salt content to 3 to 4 per cent. of the mash for 4 days is effective in controlling some outbreaks of cannibalism.

Manganese

One of the trace elements, manganese is present in only minute amounts in foodstuffs. The manganese required in the diet is amply supplied by a content of 50 parts per million (.0005 per cent.)

The essential nature of manganese in the diet is evident from the effects of deficiency. Manganese is necessary in the ration to prevent perosis in young stock and is essential to ensure high hatchability. It also affects the building up of the other essential minerals of the body, egg production, and egg-shell quality.

If bran and pollard form a considerable part of the ration, supplementing the diet is unnecessary, as mill offals are good sources of manganese. If a manganese supplement is required, it should be supplied at the rate of 4oz. of powdered manganese sulphate to 1 ton of mash. A convenient method of mixing it in the mash is to add 4oz. of manganese sulphate to 10lb. of salt and use the mixture in place of salt alone in the diet.

Effects of Manganese Deficiency

The obvious symptoms of perosis (slipped tendon or hock disease) are swelling of the hock joints and twisting of the leg bones; in an advanced case the tendons slip off the angle of the hock joint. In general the symptoms do not develop until the age of 4 or 5 weeks, and a tendency to squat on the hocks for prolonged periods may be the first apparent sign of trouble. Perosis is common in turkeys and may affect ducklings as well as chicks.

It has been found that, though manganese is the principal agent in preventing perosis, several other organic factors such as biotin, folic acid, and choline are also necessary. However, these are seldom deficient in ordinary rations and perosis is unlikely to occur if the manganese content of the diet is sufficient.

Egg production falls in adult birds on a diet deficient in manganese, and they produce eggs that have thin, fragile shells and show poor hatchability. Embryonic mortality occurs from 10 days onward and frequently chicks which do hatch are deformed.

VITAMINS

Though most of the work on vitamins has been carried out within the past 40 years, disease symptoms caused by food deficiencies are said to have been recognised by the Chinese as early as 2600 B.C. Much of the research work on vitamins has been biological, and the suitability of chicks as experimental subjects has led to the building up of an extensive knowledge of their requirement. Most of these vitamins—thiamine, pyridoxine, nicotinic acid, pantothenic acid, vitamin K, biotin, folic acid, and choline—are present in sufficient amounts in normal rations to warrant dismissing them in favour of emphasising the three vitamins most frequently deficient; these are vitamins A and D and riboflavin (also known as vitamin B_2 and vitamin G).

Vitamin A

Field and laboratory findings indicate that vitamin A is the most important vitamin and the one most often deficient in poultry diets in New Zealand.

The necessity for a constant and adequate supply of vitamin A in poultry rations is based on a number of factors:—

Vitamin A is needed to maintain the normal lining of the eyes, respiratory tract, and upper part of the digestive tract in a healthy condition. As these covering membranes have a protective function and constitute the "first line of defence" against infection, vitamin A is frequently called the anti-infective or protective vitamin.

Dietary sufficiency of vitamin A has been shown to increase the fowl's resistance to the large roundworm and intestinal coccidiosis.

Lack of vitamin A causes "nutritional roup" and is frequently a predisposing factor in outbreaks of colds and contagious catarrh or coryza.

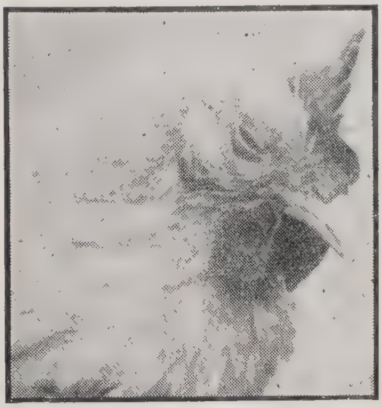
Vitamin A affects egg production and possibly hatchability. When supplied in sufficient amounts to breeding stock it is passed on through the egg to the chicks.

The principal sources of vitamin A available to the poultry keeper are fortified fish oils and suitable greenfeed.

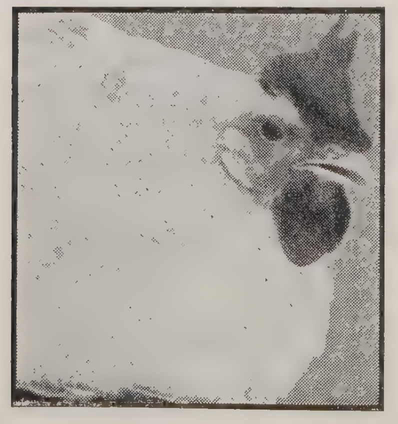
VITAMIN A DEFICIENCY IN POULTRY . . .

Greenfeed

Vitamin A does not occur as such in greenfeed, but is present in the form of carotene, a pigment which occurs also in carrots, yellow maize, and pumpkins. Carotene is converted in the body to vitamin A. Sufficient carotene is contained in about 2oz. of good, fresh, young greenfeed to supply the daily vitamin A requirement of a bird. Old, fibrous greenfeed is of no value and may give rise to digestive upsets, including impaction of the crop and gizzard. Fairly rapid loss of carotene occurs if the material is cut and stored before being fed, especially in warm weather.



Above—A bird showing the typical appearance caused by lack of vitamin A in the diet. The inflamed, swollen eyes, shrunken comb, and bedraggled appearance are symptoms of avitaminosis A. Egg production was nil. Below—The same bird after being supplied with good greenfeed for 2 weeks. The eyes had become clear and healthy, the appearance of the head had improved, and egg production had returned to normal.



Though the main value of greenfeed lies in its carotene content, it is also a useful source of riboflavin and a number of other vitamins, including pyrodoxine, vitamin E, vitamin K, pantothenic acid, and folic acid. The pigment xanthophyll, which is responsible for egg-yolk colour, is also contained in greenfeed.

Vitamin A Concentrate Oils and Emulsions

During certain seasons of the year, and particularly after a spell of hot, dry weather, the greenfeed supply may be inadequate as a source of vitamin A, and the use of a fortified or concentrate fish oil is then advisable. These oils, because of their concentration, are also of special value in supplying the vitamin A requirements of young chicks. The value of a fish oil depends on its potency; that is, the declared vitamin A content. The potency should be found clearly stated on the label of the container, and an oil may contain from 1000 to 5000 international units of vitamin A per gramme. Occasionally the amount of vitamin A is stated in units per pound of oil, in which case the number of units should be divided by 450 (1lb. is approximately equal to 450 grammes) to ascertain the number of units per gramme. Obviously, if a 5000-unit oil is used, the quantity required to supply the dietary needs for vitamin A is less than that of a 1000-unit oil.

The quantity of vitamin A-rich oil fed in the mash depends on the potency of the oil, whether an all-mash ration or a mash-grain ration is used, and the age of the stock. The table of dosages on this page, compiled by McClymont, of the New South Wales Department of Agriculture, in "Scientific Feeding of Poultry", has been modified in accordance with the recommendations of the National Research Council and is based on the optimum requirements of different classes of stock. Growing stock require 2000 international units per pound of food, laying stock 3000, and breeding stock 4500.

Some poultry keepers calculate the quantity of oil required per 100 birds instead of per 100lb. mash. It is then necessary only to estimate the amount of food consumed by 100 birds, which at the normal rate of 4oz. per bird would be 25lb. and calculate the dosage required accordingly. Proper storage of vitamin A-rich oils is very important. Oxidation by exposure to air may cause a reduction in the vitamin A content of up to 0.70 per cent. in 10 days and should be prevented as far as possible by efficient stoppering and storing in a cool place. Buying oils in large quantities is inadvisable if it means long storage. The oil should be mixed with the feed twice a week, as the vitamin A is destroyed fairly quickly after being mixed with the ration.

AMOUNTS OF OIL OF DIFFERENT POTENCIES PER 100LB. OF MASH TO PROVIDE VITAMIN A REQUIREMENTS OF POULTRY

Vitamin A potency of oil (international units per gramme)	For chickens		For layers		For breeders	
	All-mash ration	Mash and grain ration	All-mash ration	Mash and grain ration	All-mash ration	Mash and grain ration
	oz.	oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
800 ..	9	14	1 0	2 0	1 4	2 8
1000 ..	7	10½	0 11	1 6	1 0	2 0
2000 ..	4	6	0 6	0 12	0 8	1 0
5000 ..	1½	2½	0 2½	0 4½	0 3½	0 7

A pound of oil is about a pint and 1oz. about 2 tablespoonfuls.

Emulsions of vitamin A oils have now become available in New Zealand. Such emulsions have the advantage of being miscible with water and may be added to the water used to prepare a wet mash.

Vitamin A oils or emulsions are of special value during periods of greenfeed shortage or where the greenfeed is of doubtful quality. The added vitamin D makes it invaluable as a certain source of both vitamins in the concentrated rations of young chicks.

Greenfeed, however, is not completely replaced by vitamin-rich oils, and where it is available and of good quality it should be used in the ration. As a source of riboflavin and xanthophyll, which gives colour to the egg yolk, it is a valuable addition to the feed.

Effects of Vitamin A Deficiency

Complete deficiency of vitamin A or any of the other necessary vitamins leads to a train of fairly distinct symptoms, but where the deficiency is less severe diagnosis may be difficult. The only evidence of lack of essential vitamins in the diet may be unthriftiness, lack of growth, and failure to thrive, possibly associated with unusually high mortality in chicks. In laying stock border-line deficiency results in lowered egg production.

Evidence of severe deficiency of vitamin A is not usually observed until chicks are about 3 weeks old. However, if the diet of the parent stock has been deficient in vitamin A, with resultant poor storage in the egg, the effects may show at an earlier stage. The chicks are inclined to stagger, showing signs of leg weakness. The feathers are ruffled and the eyes may be gummed up. Mortality is usually high. Post-mortem examination shows the kidneys and ureturs (the tubes which run down the medial side of the kidney lobes to the cloaca) to be filled with a yellowish-white mass of urates.

Mild avitaminosis A in adult birds leads to lowered egg production and susceptibility to colds, coryza, infestation with worms, and coccidiosis. Complete deprivation of vitamin A gives rise to "nutritional roup", so called from the accumulation of discharges in the nostrils and eyes, causing swelling beneath the eyes. Affected birds cease laying and have a dejected, unthrifty appearance. Examination after death reveals the presence of numerous cream-coloured pustules on the back of the throat and oesophagus. The kidneys and ureturs are frequently speckled with yellowish-white deposits of urates.

The danger of vitamin A deficiency occurring in commercial flocks is very real and usually results from one of the following mistakes:—

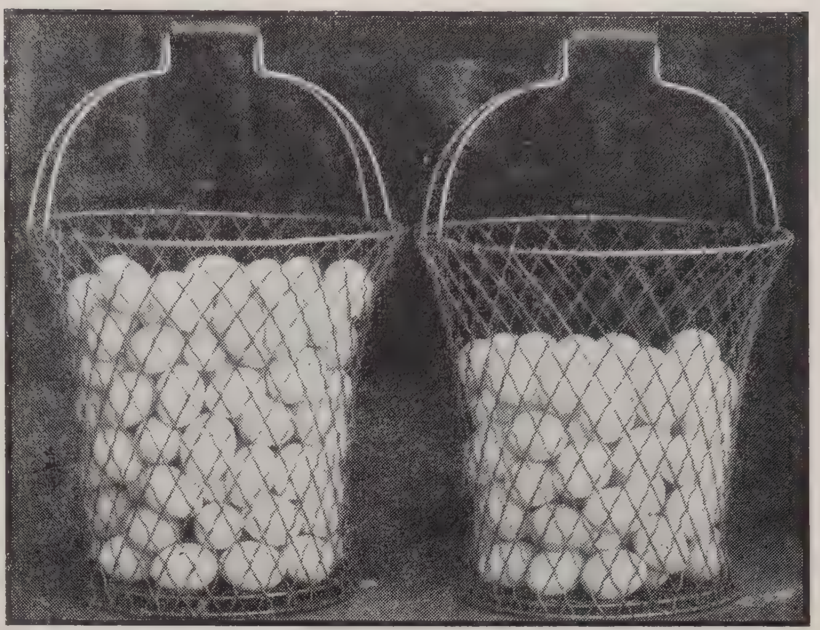
Failure to feed greenfeed or a fortified fish oil.

Insufficiency of greenfeed or poor-quality greenfeed.

Use of fish oils in insufficient quantity or of oil which has lost its potency or turned rancid because of poor storage.

Mixing fish oil with feed too long before feeding.

Affected birds may be restored to health rapidly by dosing them with vitamin A-rich oils at double the normal amounts for 2 weeks and then reverting to the usual quantities in the ration.

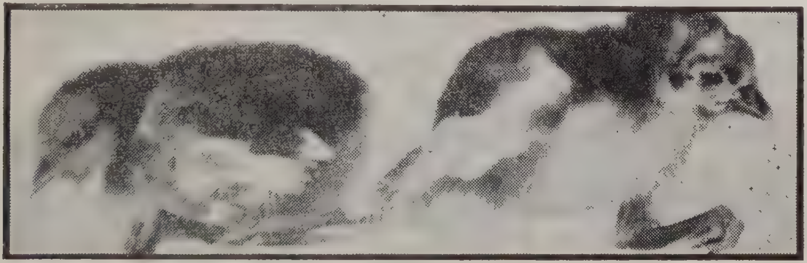


These eggs represent 5 days' winter egg production from two pens of birds, those on the left from a pen which received adequate greenfeed and those on the right from an equal number of birds which were fed neither greenfeed nor oil fortified with vitamin A.

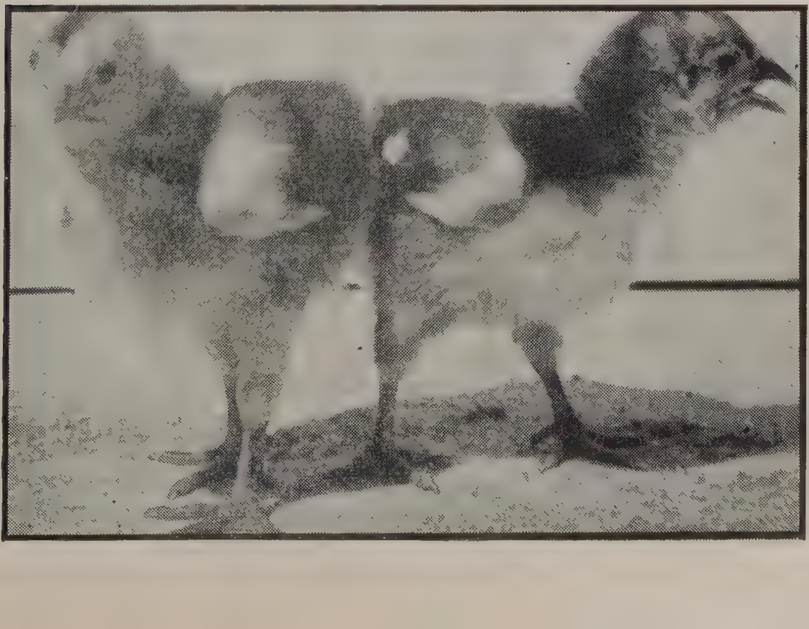
Vitamin D

Vitamin D is known as the antirachitic (rickets-preventing) or sunshine vitamin. Before the importance of vitamin D was recognised the rearing of chickens without continuous exposure to sunlight was extremely hazardous, as the normal build-up of calcium and phosphorus in the body and bone development depend on an adequate supply of vitamin D. The skin of the bird contains a substance which on exposure to the ultra-violet rays of sunlight is transformed into vitamin D_3, supplying naturally the bird's requirements. Periods of cloudy weather deprive chicks of their natural source of the vitamin.

Battery-raised or intensively reared chicks are denied exposure to sunlight and require vitamin D supplied in the diet. The fish oils containing vitamins A and D may be used conveniently to supply their requirements for both vitamins.



Above—These chicks show the leg weakness and curled toes typical of birds fed on a ration deficient in riboflavin. Below—The same chicks after 4 days of being fed a diet supplemented with pure riboflavin.



An important point to consider when buying an oil containing vitamin D for use in poultry diets is that there are several types of vitamin D. Vitamin D_3 is the effective one for poultry.

Effects of Vitamin D Deficiency

The effects of feeding a vitamin D-deficient diet usually are fully evident when chicks are 3 to 4 weeks of age. Poor growth and development are the early signs, followed by a tendency to squat on the hocks. The chicks walk with a stiff-legged gait; the beak becomes rubbery and the bones soft and pliable. Normally the birds remain quite bright in appearance despite the onset of rickets. Examination of dead chicks reveals soft bones which fail to crack when bent and a beaded appearance of the ribs caused by enlarged ends.

If kept without access to sunlight or vitamin D_3 in the feed, adult birds lay thin-shelled or shell-less eggs, egg production falls, and the birds show weakness of bones, which tend to fracture easily. Hatchability of eggs is also affected.

Rickets

The disease rickets affects principally the bones of young growing stock, causing lameness, stiffness, softening of the bones, and beading at the ends of the ribs. Crooked breast-bones may also be a form of rickets. Rickets may arise from a deficiency of vitamin D, calcium, or phosphorus; vitamin D deficiency is the most common cause, calcium shortage is a less frequent cause, and lack of phosphorus is rare.

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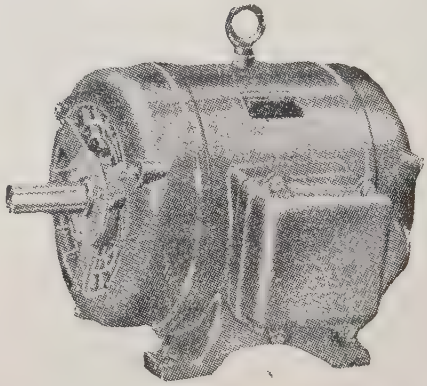

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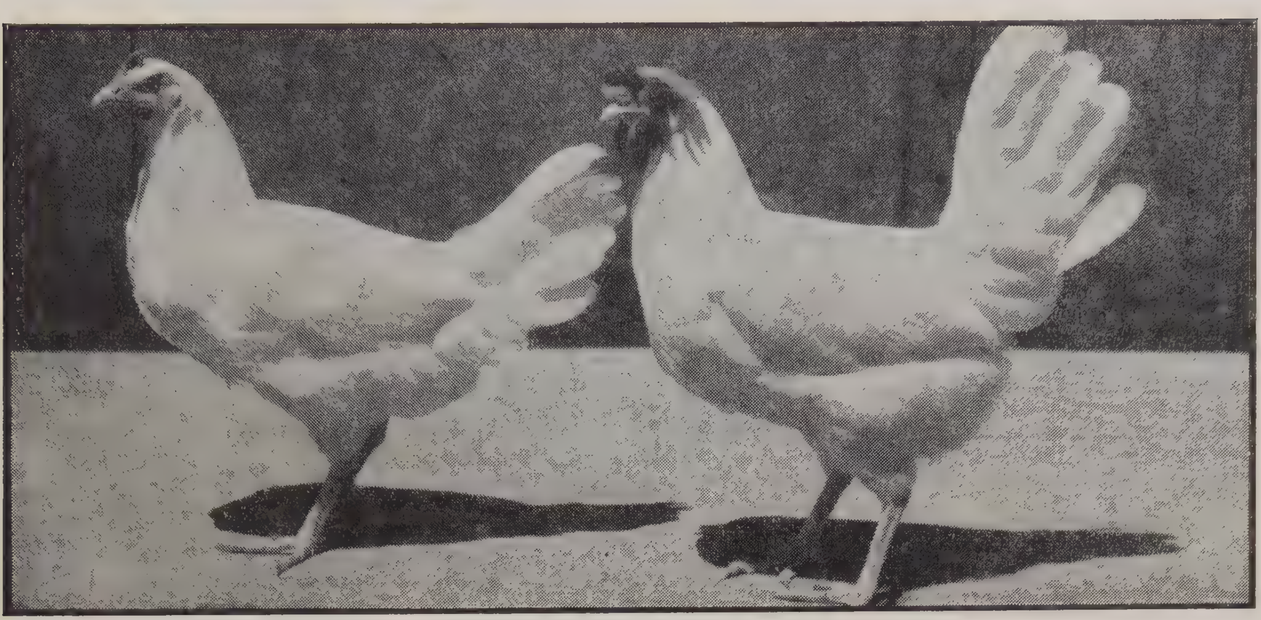
VITAMIN AND PROTEIN DEFICIENCIES IN POULTRY



Both these pullets were hatched at the same period, but that on the left was fed a ration low in protein and that on the right received adequate protein in the diet.

Riboflavin

Also known as vitamin B_2, riboflavin is the growth-promoting vitamin. It is present in good greenfeed, milk, whey, yeast, and liver. Buttermilk, skimmed milk, and whey powders are good sources of riboflavin and are extremely valuable additions to the diet. Good-quality fish meal and meat meal are reasonably good sources.

Effects of Riboflavin Deficiency

Deficiency of riboflavin in chicks' diet leads to diarrhoea, retarded growth, leg weakness, and eventually "curled toe" paralysis, causing the chicks to squat on the hocks with the toes curled inward.

Laying stock seldom suffer from riboflavin shortage, but the requirement of breeding stock is twice that of laying birds to maintain good hatchability in the eggs. An abnormal number of dead germs during the second week of incubation is a result of riboflavin deficiency.

If laying stock are receiving a reasonable supply of greenfeed, the ration does not require further riboflavin-high supplements. The needs of chicks and breeding stock, which are about two and a half times and double that of laying birds respectively, are supplied by the use of 6 to 8 per cent. of buttermilk, skimmed milk, or whey powder in the ration. Up to 2 per cent. of dried baker's yeast is also a useful source of riboflavin.

Synthetic riboflavin powder may be used as a supplement in the mash. Liquid skimmed milk and buttermilk are widely used as additions to the diet with good results. Water should also be available, and care must be taken to keep the milk containers fresh and clean.

Vitamin E

Though deficiency of vitamin E is not common under ordinary conditions, it has been observed in chicks where excessive amounts of cod-liver oil have been used in the ration. The storage of feed with cod-liver oil already added for prolonged periods may also give rise to vitamin E deficiency.

Excessive or rancid fish oil or other fat destroys the vitamin content of the ration.

Effects of Vitamin E Deficiency

Affected chicks develop a condition known as nutritional encephalomalacia or "crazy chick" disease. The chicks fall over backward or on one side when they attempt to walk. Advanced cases may be prostrate, go into convulsions, or show tremors of the head and neck.

In ducklings deficiency of vitamin E giving rise to nutritional myopathy occurs quite frequently in New Zealand. It results in degeneration and wasting of the muscles in birds 2 to 3 weeks of age, causing lameness and difficulty in standing upright. Eventually they are unable to raise their heads. The addition of wheat germ to the diet gives spectacular results.

Good sources of vitamin E are wheat-germ meal, wheat bran and pollard, cottonseed oil, and grains.

PROTEINS AND AMINO ACIDS

A great variety of proteins exists; in fact, no two foodstuffs contain exactly the same type of protein. Proteins are complex compounds which consist of a combination of simpler compounds known as amino acids. Of the large number of known amino acids only a limited number are regarded as essential. These essential amino acids must be supplied in the diet, and absence of one or more leads to loss of weight, reduced food consumption, and infertility. A protein is said to be of good quality for feeding to poultry when it contains most of the amino acids the birds require for normal growth and reproduction. Most plant proteins are inferior to animal protein. Milk powders, meat meal, and fish meal are examples of good-quality proteins.

The term protein as applied to a foodstuff such as meat meal sometimes leads to confusion. All foodstuffs contain protein, but the protein content varies widely in different materials. Maize, for example, contains about 10 per cent. of protein, wheat bran 15 per cent., skimmed-milk powder 35 per cent., and meat meal of good quality 60 per cent. Because of their high content of protein, skimmed-milk powder and meat meal are referred to as protein foods, a term which is often reduced to "proteins". Therefore, when meat meal and skimmed-milk powder are described as good-quality proteins, it must be understood that they are foodstuffs which have a high percentage of actual protein of a well-balanced type containing most of the essential amino acids.

Calculating Protein Content

This aspect must also be borne in mind when a ration is being made up from a number of foodstuffs. When a ration is being composed the percentage of protein present in each of the ingredients must be ascertained from a food-analysis table, and from these figures must be worked out the amount of each foodstuff to be added to the mash to obtain the required proportion of protein necessary for growth, egg production, and maintenance of health. A simple example of one method used may help to clarify this point.

For chicks up to 8 weeks of age the feeding of 18 to 20 per cent. of protein in the ration is recommended. When standard chick mash No. 1, which contains about 14 per cent. protein, is used, the addition of a high-protein foodstuff is necessary to supplement the amount of protein and bring the content of the mash up to the desired 18 to 20 per cent. Meat meal and skimmed-milk powder are two of the protein supplements in common use.

The food-analysis table shows that meat meal contains 60 per cent. of protein (that is, 100lb. contains 60lb. of protein) and skimmed-milk powder contains 35 per cent. protein.

100lb. of standard chick mash No. 1 (14 per cent. protein) supplies 14lb. of protein

10lb. of meat meal (60 per cent. protein) supplies

$$\frac{60 \times 10}{100} = 6\text{lb. of protein}$$

8lb. of skimmed-milk powder (35 per cent. protein) supplies

$$\frac{35 \times 8}{100} = 2.8\text{lb. of protein}$$

The total quantity of mash is now $100 + 10 + 8 = 118$lb. containing $14 + 6 + 2.8 = 22.8$lb. of protein

Therefore 100lb. of mash now contains

$$\frac{22.8 \times 100}{118} = 19.3\text{lb. of protein}$$

That means that the supplementary mash contains 19.3 per cent. protein and is suitable for the feeding of chicks from a day old to 8 weeks.

Amino acid deficiencies are unlikely to arise under the usual feeding conditions in New Zealand.

Protein Requirements

The value of a poultry ration depends to a considerable extent on its protein content. The normal functions of the body require constant replacement of the protein which is being used up. The protein of the ration is broken down to the simpler amino acids during digestion; these acids are absorbed from the intestine through the bloodstream and are reconstituted into the type of protein required by the body.

Protein is required by poultry for growth, feathering, and egg production. If the protein content of the ration is too low, the rate of growth and feathering is slow. Egg production is directly affected, and laying birds on a protein-deficient diet yield poorly and go into an early moult. Resistance to disease is lowered and cannibalism may break out in the flock.

Both quantity and quality of protein are therefore of great importance in the formulation of poultry diets.

The protein requirements of different classes of stock vary considerably and, as this article is concerned only with the effects of nutritional deficiencies, the recommended amounts of proteins will be summarised. They are:—

Type of stock	Protein requirement (per cent.)
Chicks up to 6 weeks old	18 to 20
Growing stock 6 to 24 weeks old	12 to 15
Laying and breeding stock	15

If a mash-grain ration is being fed to stock requiring, say, 15 per cent. of protein, the mash should contain up to 20 per cent. of protein to allow for the fact that the grain portion of the ration provides only 10 per cent. of protein.

Growing stock on good range frequently thrive on the lower percentage of protein (12 per cent.) in the ration, as they pick up insects, earthworms, and slugs, which contain animal protein, in addition to the vegetable protein of the pasture.

FIBRE

A fowl is unable to digest fibre effectively, and the presence of excess fibre in the diet leads to indigestion and crop binding. Fibre is necessary to give bulk to feeding stuffs, but the diet should not contain more than 8 per cent. of crude fibre. Oats, bran, and greenfeed are high in fibre content, and excess feeding of these materials may lead to poor growth and production.

The presence of excess fibre in the diet reduces the amount of readily digested carbohydrates (starches). In general, the energy content of the ration is inversely proportional to the amount of fibre in the diet; that is, the higher the fibre content, the lower is the energy value of the diet. There is also evidence to show that excesssively fibrous food (including poor, rank pasture) predisposes young stock to coccidiosis.

WATER

The inclusion of the subject of water in an article on the effect of nutritional deficiencies is not out of place. Water is such an essential and integral part of the ration that it is usually taken for granted. It is only necessary to consider a few of the functions which water performs in the body to realise the importance of an adequate supply to birds.

Water constitutes up to 75 per cent. of the body weight of a bird and more than 65 per cent. of the weight of an egg. It is required for the process of digestion, assimilation, and absorption of feed. It is essential for the formation of blood and lymph and the removal of waste products. Temperature or body heat is controlled by evaporation of moisture from the body. These are but a few of the requirements of the body metabolism for which water is essential.

Poultry will survive without food for a considerable period, but for only a short time without water. Shortage of water for a day or even part of a day results in a fall in egg production and a rise in the mortality rate in adults and chicks. Digestive upsets are also common sequels to an irregular or poor water supply, particularly where dry mash is being fed.

Therefore, to obtain good results in raising young stock or to keep laying birds in production a regular water supply is of primary importance, and, in view of the role of water in transmitting disease, the water must be clean and fresh.

The consumption of water varies with the weather. In hot weather larger amounts are needed, but the approximate quantities drunk daily by 100 birds at different ages are as follows: 1 week, 1 gallon; 2 to 5 weeks, 2 gallons; 6 to 9 weeks, 3 gallons; 10 weeks, 4 gallons; older than 10 weeks, 5 gallons.

DIET MOST IMPORTANT FACTOR

Dietary deficiencies, with consequent disease, slow growth, and poor production and hatchability, will result from failure to provide poultry with the essential minerals and vitamins required. Under New Zealand conditions, if attention is paid to the provision of calcium, phosphorus, salt, and manganese, vitamins A and D and riboflavin, and an adequate percentage of protein, there is little chance of such conditions arising.

Though the details of the deficiency diseases and the requirements of the essential elements of the diet have been described only briefly, the information given should suffice to indicate the measures to be taken to ensure that the ration supplied to fowls is adequate and complete.

Many factors other than diet must be taken into consideration in running a poultry farm successfully, but nutrition is the most important single environmental factor governing the health of the birds.

Radio Broadcasts

THE following radio talks will be given to farmers from Station 1YA Auckland at 7.15 p.m.:—

March 14—"Fertiliser Supplies and Topdressing", by P. W. Smallfield, Director, Extension Division, Department of Agriculture, Wellington.

March 21—"Pasture Establishment", by J. E. Bell, Fields Superintendent, Department of Agriculture, Auckland.

March 28—"Improvement of Pastures of the Coromandel Peninsula", by G. L. Banfield, Instructor in Agriculture, Department of Agriculture, Thames.

Talks to farmers will be given from Station 1XH Hamilton at 8.45 p.m. as follows:—

March 5—"Seed Pelleting", by T. F. Southon, Technician, Soil Research Station, Rukuhia.

March 12—"Pasture Establishment", by J. R. Murray, Instructor in Agriculture, Department of Agriculture, Hamilton.

March 19—"The World Meat Trade", by G. A. Walsh, Waikato Branch of Federated Farmers.

Other talks are given from 1YA Auckland on Tuesdays at 12.35 p.m., 2YZ Napier on Tuesdays at 7.10 p.m., 2YA Wellington on Thursdays at 12.35 p.m., 3YA Christchurch on Mondays at 12.20 p.m., and 4YA Dunedin on Thursdays at 12.35 p.m.

Pig Broadcast

Under the auspices of the Bay of Plenty District Pig Council a broadcast will be delivered in March as follows:—

Rotorua—1YZ, on March 22, "Pig Carcass Competitions and their Lesson", by A. F. Barwell, Supervisor, Bay of Plenty District Pig Council.

Field Survey of Housing in Vincent County

FACTORS AFFECTING WORK IN THE HOUSEHOLD

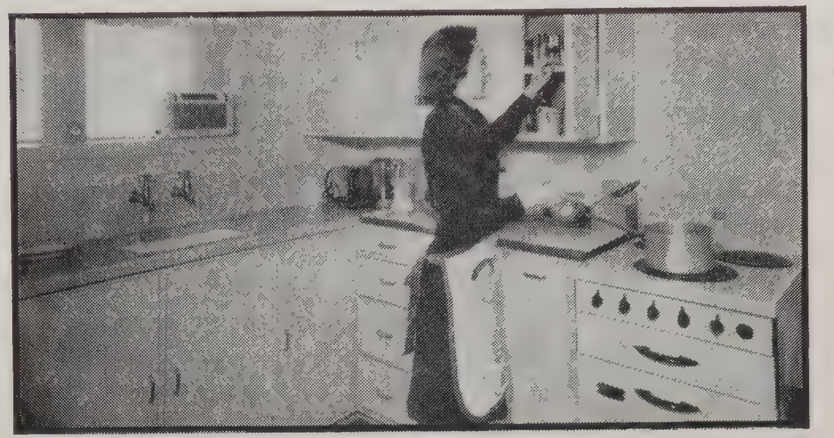
FACTORS affecting the work of the housewife are analysed in this, the last of three articles by Edith G. McNab, Rural Sociologist, Department of Agriculture, Timaru, based on a survey of rural homes in Vincent County, Central Otago. The first two articles were published in the December and January issues of the "Journal".

ONE of the most obvious factors affecting the amount of work to be done in a home is the size of the household, but the number of people living in the house is only a rough guide to the amount of work required of the housewife, for the ages of the members of the household also have an effect. Babies and small children need more attention from the home maker than do adults, unless the adults are either ill or very old, and when there are young children in the home the housewife spends much more time "on duty". She may have very little time free from the responsibility of supervising the activities of the children, even when she is not actively engaged in feeding or otherwise caring for them.

Therefore, for the purposes of comparing the labour loads of Vincent County housewives caused by the numbers of members in their households, a young child was counted as more than one, how much more being decided according to age and after discussion with a number of mothers. The figures are only approximations, but gave a better basis for comparison than unadjusted numbers. Up to 3 years of age a child was considered to need as much work as that required by two adults, so a child of, say, 2 years of age was counted as two in adult equivalents; from the ages of 4 to 7 years inclusive a child was counted as one and a half adults, from 8 to 16 years as one and a quarter adults, and a child older than 16 as one adult. Where men were employed and lived in separate quarters, but had meals at the house, each was counted as half and added to the total number for the household.

Of the 107 households visited, 62 contained children 16 years of age and younger. Five of these households contained children from all three of the age groups, 22 families included children from two age groups, and 35 had children from one age group; 21 families included one child each, another 21 families two children each, 10 families three children each, and 10 had four or more children. Thirty-one mothers—that is, half the families with children—had children 3 years of age or younger to care for.

Nearly equal percentages of the county and borough households counted children among their numbers, but proportionately there were more larger families in the country. Vincent County conforms to the tendency the world over for rural areas to have larger families than those in the towns of the same country.



[*National Publicity Studios photo.*

For the most part it is the housewife herself who does the work of the home, and when hard pressed she has to seek substitutes for another pair of hands. The survey on which this series of articles is based showed the extent to which families in Vincent County are calling on electric-powered servants to provide such substitutes.

Calculating the Labour Ratio

The number in the household, even with children added in as adult equivalents, is still not suitable for comparison of the work loads of housewives on the basis of sizes of households. To arrive at a figure which can be used for this purpose the labour ratio was calculated. This is found by dividing the number of people in the household (counting children as adult equivalents) by the number of women doing the work of that household.

Where the housewife had one full-time assistant, such as a daughter older than 16 or paid help, the number of people in the household was divided by two to give the labour ratio. Where an elderly relative was capable of assisting part of the time she was counted as half-time help. Where the only help received by the housewife was assistance in washing or drying dishes, or where an older child made its own bed, the number of workers was taken as one. Most households where the labour ratio was high contained children. The highest ratio found was twelve—that is, one housewife had the equivalent of twelve adults to keep house for; one visit was sufficient to reveal excellent organisation by this housewife and good co-operation from her family.

Many women raised the subject of lack of domestic aid and would employ help if they could get it. Only five of the 107 homes had full-time paid help and none had part-time paid help regularly. Some farmers' wives had extra paid assistance during such times as shearing, harvesting, and fruit picking; this was easier to obtain during school and university holidays, when students could be called on. Full-time help was provided by daughters in eight households and by other female relatives in two more. In another two homes elderly relatives were able to give part-time assistance.

Most women who receive help from daughters can expect to enjoy it for only a limited time. Whether this period coincides with the time of greatest need varies with family circumstances. Mothers themselves often take the initiative of sending their daughters away, even though help in the home would be welcomed, for at present in most country districts there is nothing a girl can look forward to as a lifetime occupation unless she marries and has a household of her own. The farm will probably pass to a brother, and when he marries there is not likely to be a place in the home for the sister. In the past too low a value, both social and economic, has been set on the work of women in the country. In the interval between growing up and marrying many girls find more congenial and better-paid work in towns.

So it is the housewife herself who does the work, with an interlude of assistance for a few years if she is lucky. When hard pressed she has to look for substitutes for another pair of hands.

Electric Equipment

Such substitutes may be electric labour-saving devices. Vincent County is fortunate in having electricity in about 94 per cent. of its homes, but electric equipment can be used only by those who can afford it and many women still must do without, no matter how heavy their labour loads. The following table shows the items of electric equipment owned in the 107 homes visited:—

Type of equipment	Percentage owning
Iron	92
Range	52
Vacuum cleaner	51
Refrigerator	27
Washing machine	24
Dish washer	6
Ironing machine	6

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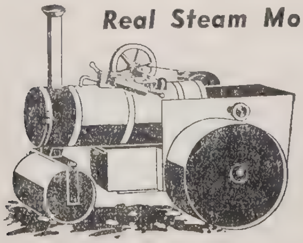

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SURVEY OF HOUSING IN VINCENT COUNTY

[V. C. Browne photo.

Orchards near Clyde, in Vincent County. The survey on which this series of articles is based showed that some homes on fruit farms contained a large number of labour-saving devices. That was attributed to the wife's preoccupation with orchard work during the picking season.

The order in which items of equipment are bought varies after the iron, which nearly always comes first. That the percentage of homes owning irons is less than the percentage having electricity is explained by the fact that some country homes have their own lighting plants. An iron is the least expensive item. The higher proportion of cleaners than of washing machines, refrigerators, and dish washers probably is to some extent a result of their lower cost. The degree of usefulness of each item varies with household circumstances. A vacuum cleaner is of much greater benefit to a woman who has many carpets to clean than to one whose house has linoleum floors. Refrigerators provide the best way of keeping foods in the hot summers of Central Otago. Very few people owned electric food mixers.

Prejudices exist about the use of some types of equipment. For example, some women refuse to believe that washing machines can clean clothes as well as hand washing. Such prejudices are disappearing as more equipment comes into use and the results can be seen by friends and neighbours. Many women who could afford it and who had either large households or special motives for increasing leisure time were acquiring as many items of electric equipment as possible. There is real need for an information service about the choice and use of equipment for different purposes.

The Family Cycle

The following table compares some averages for factors affecting the work of the housewife according to stages of the family cycle:—

	Number in household	Labour ratio	Number of labour-saving devices
1: Couple with no children	2.14	2.07	1.00
2: Couple with children aged 16 and younger	4.88	5.55	1.14
3: Couple with grown-up sons and daughters at home	3.66	2.50	2.00
4: Husband and wife left alone	1.88	1.87	0.80

Included in the number of labour-saving devices shown in the table are washing machines, vacuum cleaners, dish washers, refrigerators, and ironers. Most households have an electric iron in addition to any of these. Some housewives have no labour-saving devices other than an electric iron, and a few have three, four, or five in addition to the iron.

The figure for the size of the household in the last stage of the cycle is explained by the fact that several homes were occupied by widows.

The labour ratio is highest for families with children aged 16 and younger. Only 7 of the 62 families at this stage of the cycle had full-time domestic help, the help coming from elder daughters in all but one family. The highest number of labour-saving devices is owned by the families in the third stage of the cycle, not in the second stage, when the labour load is greatest. By the third stage the family is likely to be better established financially.

Members of the household can reduce the housewife's burden by carrying out tasks or eliminating the need for some tasks. Co-operation from all who use equipment in leaving it in good condition—for example, by cleaning the bath after use—makes a great difference to the amount of time and effort the housewife has to spend on such work. Quite young children can learn to keep their personal possessions tidy, to put away articles they use, and to avoid thoughtless actions which cause unnecessary work.

The house itself as a factor influencing the housewife's work was discussed in the previous article of this series in last month's "Journal". Even if structural defects cannot be remedied, improved arrangements in the work areas of the house, such as the kitchen and laundry, are often possible. For example, by contriving that things used most often are the most easily accessible, and that all the articles needed for a job are kept together and as near as possible to the place where they are required, the housewife can make the best use of existing storage space.

Influence of Occupation

The housewife's work is influenced by the occupation of her family. The routine of a farmer's wife must be more flexible than that of a housewife in a town, where members of the family are more likely to be home at regular hours for meals and where casual visitors for meals are fewer.

Changes of season on a farm may entail a complete reorganisation of work in the house. During shearing or harvesting all else must be subordinated to providing meals to enable the work outdoors to continue at full speed while the weather is favourable. For most housewives this necessitates much preparation of food ahead of requirements. Any interruption through bad weather or any other cause means another reorganisation by the housewife to use up the stock of perishable foods left on her hands and to be ready again when the weather improves.

On orchards lack of competent help during the picking season may necessitate the wife supervising the work in the packing shed while her husband is in the orchard—this in addition to the usual care of the family and provision of meals for increased numbers. There lies the reason for the large

[Photograph above by Sparrow Industrial Pictures Ltd.

As well as her productive work indoors, the housewife may care for poultry and the garden. Where fowls are kept, most frequently it is the housewife who looks after them. If care of the garden is divided between husband and wife, the wife is likely to attend to the flower garden and the husband to the vegetables.

number of labour-saving devices in some of the homes on fruit farms.

The effects of farming as an occupation are bound up with the consequences of distance from a town. The farm housewife must rely more on her own efforts than does the housekeeper in a town. She cannot go round the corner to a shop if she requires extra food; greater quantities of food and household supplies must be kept in reserve. The farmer's wife must plan ahead for a longer period and her planning must be more thorough. She is likely to have to spend more time on the preliminary stages of production of material goods than does a town housewife, and fewer services are available to her. If the weather is wet for a week, she cannot send her washing to a laundry.

Occupations in which the hours are irregular, such as shift work on the dredges in Vincent County or the work of a stock agent, may necessitate alteration of meal hours or separate meal times for different members of the household. As meals are frequently the fixed events of the day round which other work is planned, this can imply complete reorganisation of the housewife's day. Children going to school may arrive home for lunch at a time different from that of the father of the family, or country children who travel by bus and have a long day away from home may require meals at times which do not fit in with the needs of the rest of the household. Duplication of some tasks cannot be avoided if meals must be taken in two sittings. In families where primary school children are doing correspondence lessons supervision of these is added to the mother's tasks.

Occupation	Number in household	Labour ratio	Number of labour-saving devices
Farming ..	4.23	5.08	1.4
Business and wage earning	3.63	4.25	1.0
Retired, widows, etc. ..	2.57	3.07	Less than 1

Some average differences between households classified according to occupation are shown in the table below.

On the average, farm women have larger households and higher labour ratios than women whose husbands are engaged in other occupations, but they also own more labour-saving devices, and on the whole their houses are as convenient for work as those in the townships. However, these factors are not necessarily sufficient to offset completely the effects of the higher labour ratio.

Sewing and Mending

Some sewing and mending is done in every household, and 92 per cent. of the housewives in Vincent County had a sewing machine to assist in this work, 10 of the machines being electric. About a third of the women who had a sewing machine did no sewing other than mending. Most home sewing included the making of children's garments, dresses, and aprons and household sewing. Very few women attempted to make boys' outer clothing or coats.

Most mothers tried to make at least some of the children's clothes, even if they said they disliked the work or were not good at it, probably because quite a substantial saving of money can be made by sewing outer garments instead of buying them. Underwear is usually bought. For women who are very busy, buying garments instead of making them is one way of reducing the amount of work to be down.

Fowls and Gardens

As well as her productive work indoors, the housewife may care for poultry and the garden. Where fowls are kept, most frequently it is the housewife who looks after them.

If care of the garden is divided between husband and wife, the wife is likely to attend to the flower garden and the husband to the vegetables. If the home garden is depended on for fresh vegetables all the year round, more labour is involved than in a small town garden which is used only to supplement supplies bought. In the dry climate of Vincent County supplying water poses a problem which adds to the work of caring for the garden. Maintaining the supply of vegetables during dry or cold weather adds to the housewife's difficulties in keeping a good level of nutrition for the family.

On some farms where only one cow was kept for the house the farmer's wife milked it. Most other outside work done by the housewives was seasonal, not regular.

The Heaviest Burdens

When home making is considered in all its aspects the tentative conclusion that women whose families include children aged 16 or younger have the heaviest burdens of work is confirmed. Women with young children have the highest labour ratios and are least likely to have help, so that they have little respite from caring for their children.

It is these women in particular that the Rural Sociologists are glad to help with information which will assist them to make the best use of what resources they have.

◆

CHANGES OF ADDRESS OF "JOURNAL" SUBSCRIBERS

To ensure continuity of delivery of issues of "The New Zealand Journal of Agriculture", subscribers are required to give 4 weeks' notice of change of address. The old address (preferably an address label clipped from a recent "Journal" envelope or wrapper) and the new address should be sent to the nearest office of the Department of Agriculture.

◆

PLANNING A GARDEN FOR THE COUNTRY HOME

INITIAL planning is the first factor which will make or mar a garden. The plan is fundamental to all that will follow, for even the most favourable of sites can be spoilt by lack of foresight, whereas some of the most unfavourable sites in New Zealand have been converted to gardens of rare beauty at the hands of imaginative workers. In this month's article for the flower gardener C. K. Ellis, Horticulturist, Department of Agriculture, Dunedin, discusses some of the problems which invariably arise in the planning of a modern garden for the country home.

MOST of the problems to be overcome in planning a garden are very practical, and primary among them is the size and shape of the block of land to be considered.

A square or rectangular section is usually the first choice of the gardener who prefers the formal or essentially symmetrical type of layout, because it conforms most readily to his conception of a good garden design. The gardener who favours the informal layout is not greatly concerned if his section of land looks like an odd corner, because he is able to fit his design into almost any shape with which he is confronted.

Before beginning the preparation of the final plan the gardener must decide exactly what is to be grown, for certain features require a specific amount of space. Features such as rose and rock gardens or garden pools may be modified in size to fit the surroundings, but fruit trees or specimen trees require a definite amount of room, and economising in space for them will result in unproductive and poorly grown trees. If one particular feature is decided on, it must be developed at the sacrifice of a reduction in size of minor features.

The next consideration is whether the feature decided on is more fitting in a formal or an informal layout. A century ago the formal garden seemed the most fashionable, but more recently opinion among garden planners changed considerably in favour of the informal. At present, though many strictly formal gardens are being laid out, and equally as many informal ones, landscape architects on the whole are compromising and achieving what usually are extremely pleasing results.

Great consideration must be given to the placing of garden paths, because their permanent or semi-permanent nature brands them as the main structural work of the garden—something which cannot always be moved at will should an unsatisfactory effect be the result of too little thought.

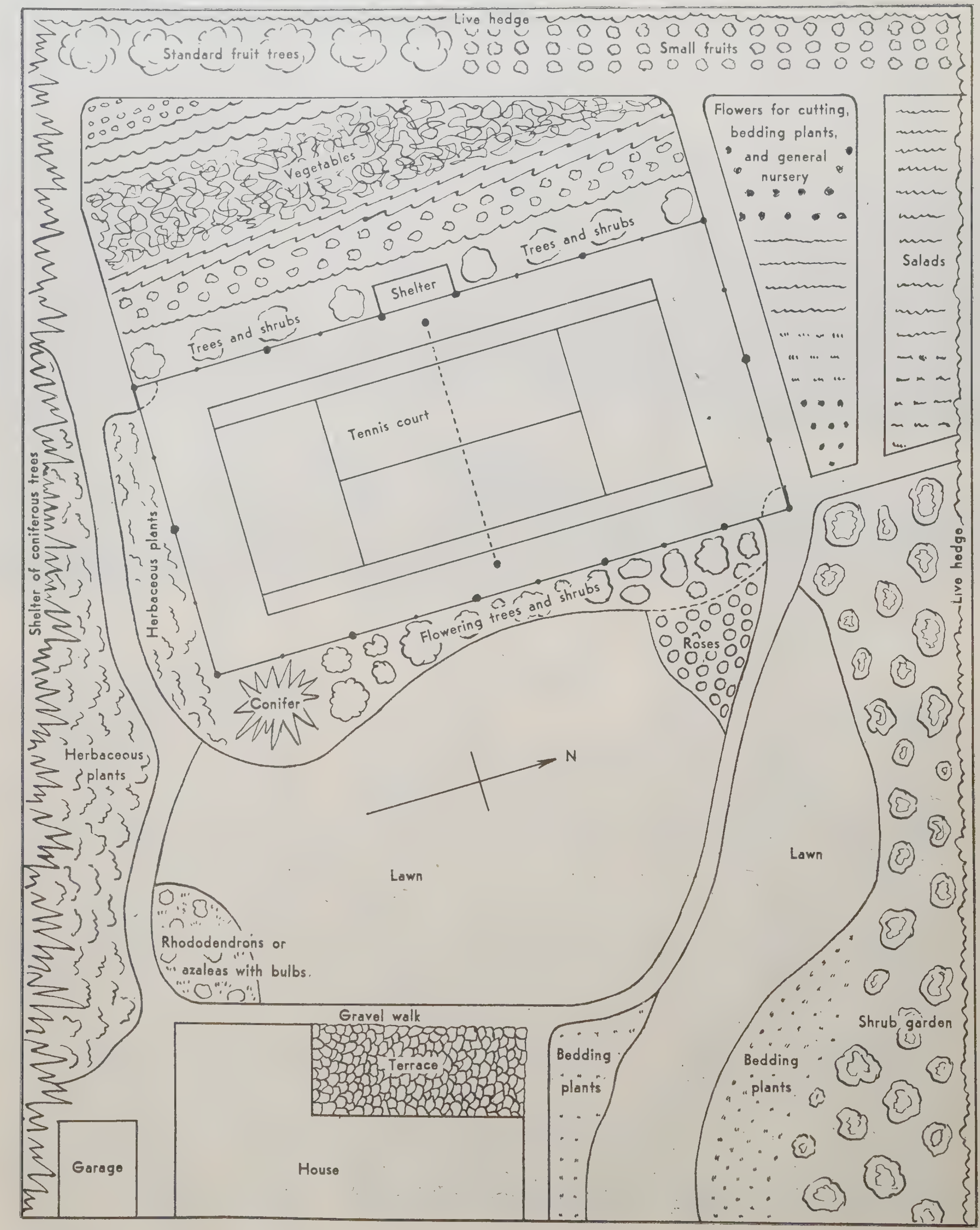
With the positions of the paths firmly in mind, the gardener should draw a scale plan. This plan is not only useful as a reminder of what has been decided on, but is also invaluable to other people who wish to assist by taking an active part in the programme of development. However, even when a garden plan has been completed it need not be adhered to strictly like the final plans for a house. The plan should have some degree of elasticity to allow for improvements and alterations to the original scheme, but every endeavour should be made to complete the layout before constructional work is begun.

Aspect of Garden Features

The next factor to be considered is the aspect of the site—its relation to sun and shade or, more correctly, to the compass. Should the owner's house be already on the site, he has no alternative to making the most of the situation, but if the house is yet to be built, the careful placing of it will eliminate a great number of problems of aspect in the garden.

Heading photograph by Douglas Elliott.

SUGGESTED GARDEN PLAN FOR A RECTANGULAR SECTION


Live hedge
Standard fruit trees
Small fruits
Vegetables
Flowers for cutting, bedding plants, and general nursery
Salads
Trees and shrubs
Shelter
Trees and shrubs
Tennis court
Shelter of coniferous trees
Herbaceous plants
Flowering trees and shrubs
Live hedge
Roses
Conifer
Herbaceous plants
N
Lawn
Lawn
Rhododendrons or azaleas with bulbs
Shrub garden
Gravel walk
Terrace
Bedding plants
Bedding plants
Garage
House

Herbaceous borders, rose gardens, and rock gardens should be given the sunniest positions and the shady places left for subjects that favour such localities. The orchard should be in as sunny a place as possible, and the vegetable garden, being less exacting in its demands for sunlight, can well be placed in a partly shaded position, provided it is open to the air and free from the roots of trees.

It is often possible, and especially desirable where there is a growing family, to provide a tennis court within the boundaries of the country garden. The court is likely to be used most in the evenings, when the sun is low, and because of this the long axis should run as nearly as possible north and south to eliminate dazzle in the eyes of the players.

Any small glasshouse structure should also have its long axis running north and south.

Where possible the rock garden should be given a northerly aspect, but a less sunny site will suffice, though a much smaller range of species will be able to thrive in it. Where shade for some plant is required in a sunny rock garden it can usually be supplied by careful placing of a large rock or by growing a small shrub.

Trying to utilise a clay bank or an unsightly corner as a site for a rock garden is a mistake. Nothing could be more unsuitable.

Disadvantages of a Flat Section

Though a perfectly flat section looks at first sight the easiest type to lay out, a little experience will show that one with gentle slopes lends itself much more readily to landscaping. The slight slopes make attractive lawns, those a little steeper can form pleasant terraces, and the steepest are ideal for rock gardens and dry walls. Depressions suggest their development as sunken gardens and in some cases garden pools.

[Photographs on this page by Douglas Elliott.

The site for a rock garden must be chosen carefully. Trying to utilise an unsightly corner or clay bank is useless.

Provided natural drainage is good, the unfortunate gardener with flat land can raise some parts with soil excavated from others, so creating an undulating effect. However, this procedure is unwise without full knowledge of the depth of soil available and the highest point reached seasonally by the water-table. A good plan is to dig three or four deep holes about the site and watch the level to which water rises in them during rainy periods.

Suggested Plan

The suggested country garden plan on the opposite page is based on a flat, rectangular section of the type which lends itself least to landscaping.

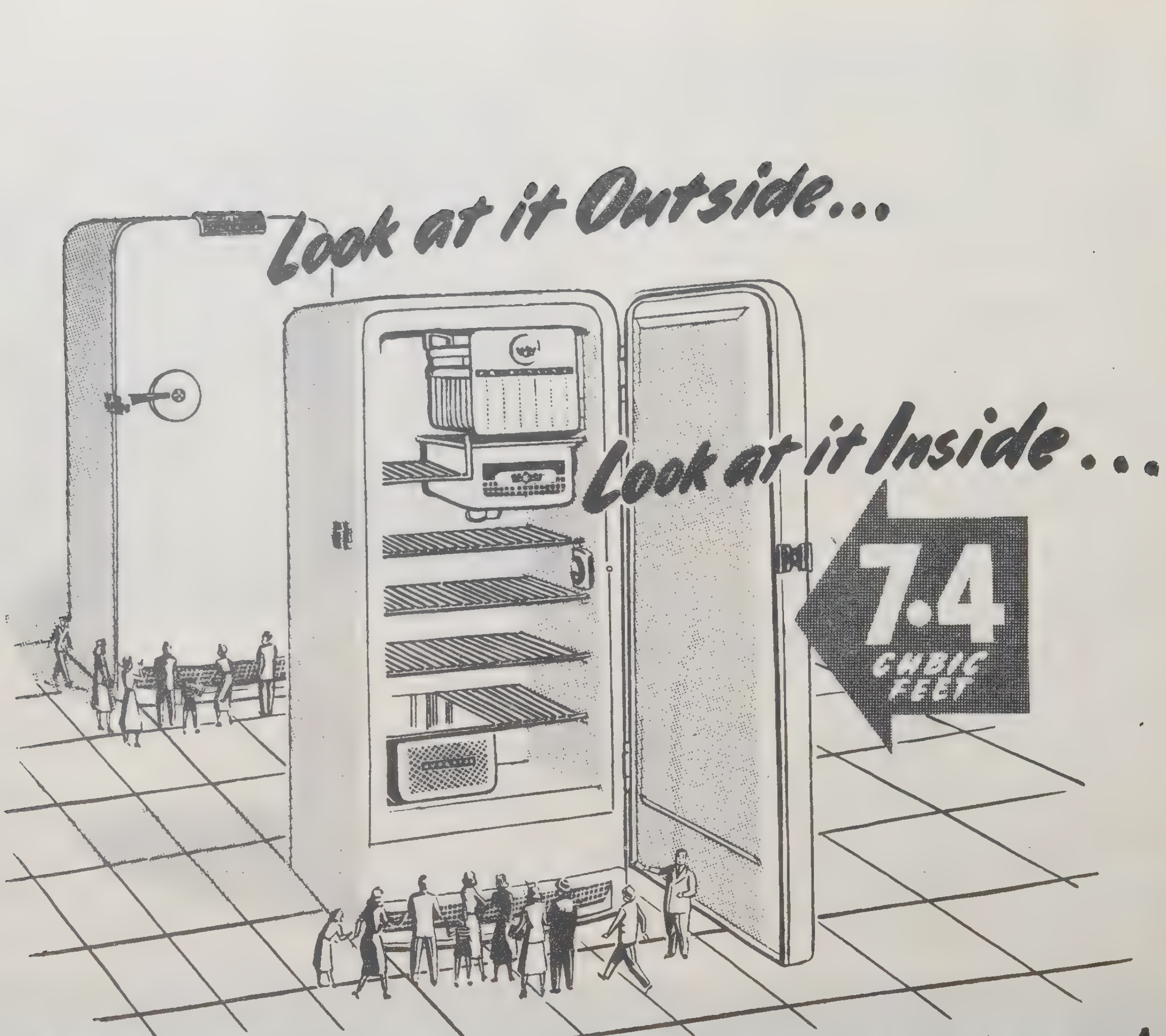
The rectangular lines of the plot have been broken as far as possible by the introduction of curves.

The tennis court has been placed with its long axis running north and south and is hidden from the house by a border of trees, both flowering and coniferous.

The entry of cold winds from the south has been restricted by the placing of a belt of shelter trees along the southern boundary, but the entry of sunlight from northerly quarters is unrestricted because no tall trees appear on any other boundaries.

The vegetable garden and orchard are not visible from the house.

A small pool makes a pleasing feature in any garden.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FLOWER GARDEN WORK FOR MARCH

Annuals sown earlier in the year where they are to flower next season should be thinned as soon as they can be handled. At the first thinning the seedlings should be left at least 1in. apart, but they should not be thinned too much in autumn, as many of the plants may succumb during winter. Final thinning is done in spring when they start to grow strongly. Seeds of hardy annuals—sweet peas, calendulas, larkspurs, viscaria, Iceland poppies, and antirrhinums—can still be sown. Seedlings grown outdoors are hardy enough to stand winter weather and produce early-flowering plants next spring.

Bulbs and corms which may be planted in March to flower in spring include hyacinths, tulips, narcissi, crocuses, freesias, lachenalias, ixias, grape hyacinths, sparaxis, and babianas. Hyacinths do best in a deep, rich soil in which liberal dressings of compost or other forms of humus have been incorporated. Narcissi prefer a soil which contains no fresh manure and has not been limed recently; a dressing of blood and bone worked deeply into the soil before planting will improve both the quality of the flowers and the size of the new bulbs produced next summer. Tulips like soils recently limed and dressed with blood and bone and superphosphate (1oz. of each to a square yard).

Carnation layers which were pegged down in December should now be well rooted. They should be separated from the parent plant and transplanted into the border where they are to flower next year.

Cuttings of violas and pansies can still be rooted in cold frames if insufficient have been propagated to make a bright show next year.

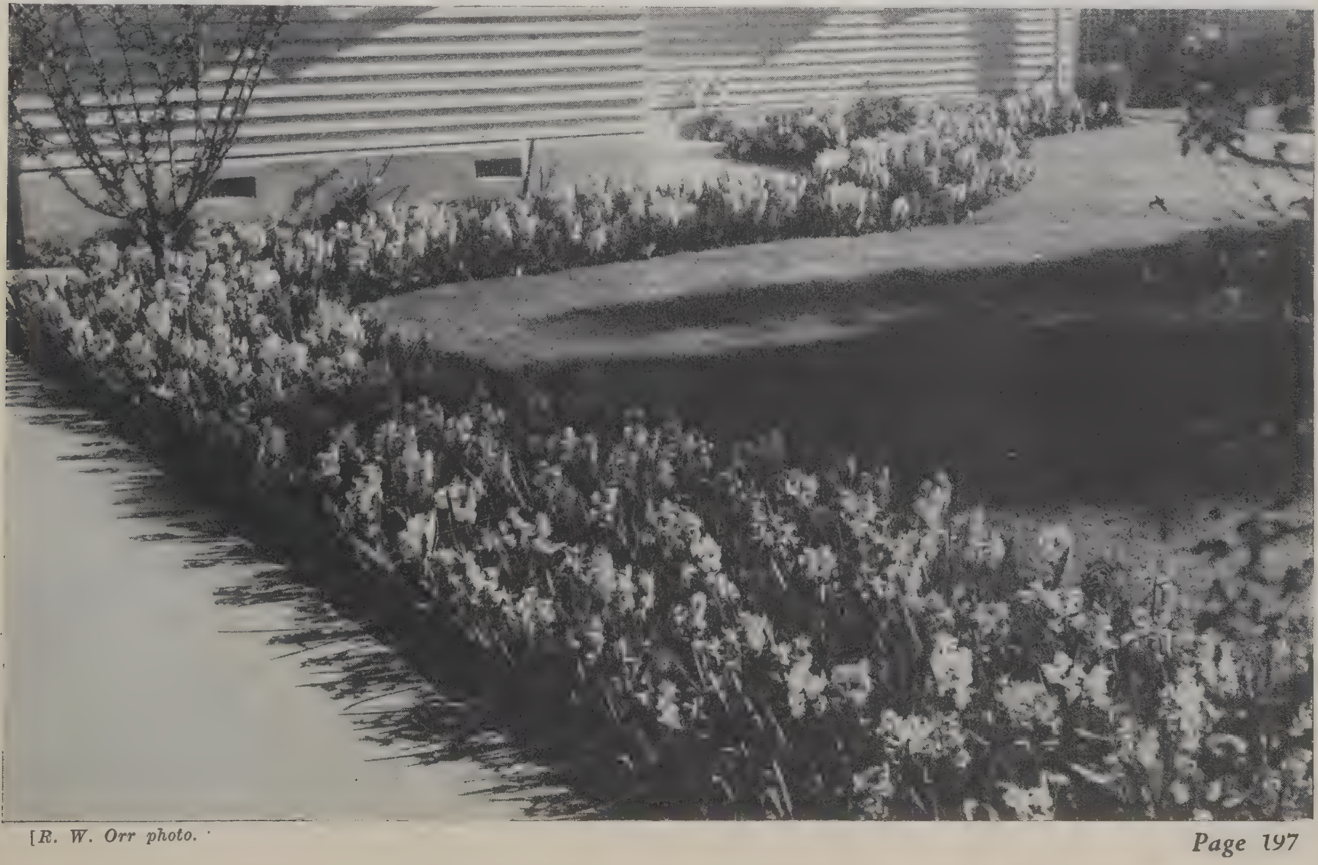
Flower heads should be picked off as flowers fade from herbaceous plants. This is an everlasting task in the flower garden, but one that is repaid by the prolonging of the flowering season as late into autumn as possible.

Ranunculuses thrive in well-drained soil. Waterlogging injures the roots and makes the plants yellow and unhealthy. Large, healthy plants can be produced only in reasonably rich soil, but they do not like fresh manure. The tubers are best planted in a soil which was well manured last season after they have been soaked for 12 hours. They should be set 4 to 6in. apart and 2in. deep, with the claws of the roots pointing downward. Most good strains produce a high proportion of double and semi-double flowers, but all strains contain a proportion of single ones.

Geraniums can be propagated easily from cuttings. Though these will root at almost any time of year, they are best taken in summer and autumn. Pieces of new growth 3 to 4in. long should be cut off and the base of each carefully trimmed back to just below a leaf joint. The bottom two or three leaves should be removed and the cuttings dibbled 3in. apart into sand in a frame or sandy soil in a warm border. The hole should be made with a flat-ended dibble so that the cut end of the cutting is in contact with the soil. Cuttings require very little water until they start to grow.

[*Douglas Elliott photo.*

Tulips (above) and hyacinths (below) may be planted in March in most districts to provide spring blooms.



[*R. W. Orr photo.*

FLOWER GARDEN WORK FOR MARCH . . .

Iris species which flower in winter should be planted in March in light, well-drained situations. Liming the soil is an advantage, as the species do not thrive if the soil is acid. *Iris unguicularis* (more usually called *I. stylosa*) is a lovely species with pale violet petals and a deep yellow throat surrounded by a white ground with purple markings. *Iris reticulata* has velvety purple petals and an orange throat. Both these species will flower regularly in winter, and are best left for some years without being lifted if the situation seems to suit them.

[*Douglas Elliott photo.*

Iris unguicularis is one of the species which flower during winter, and its tuberous roots may be planted in March.

Lawn establishment is easiest from an autumn sowing in all but the coldest districts. Seed may be sown in March or April provided the soil has been thoroughly and evenly firmed and a shallow, loose surface layer obtained. Grass seed should never be sown on loose, lumpy soil, which later will settle and cause irregularities in the surface. The mixture of seed recommended is 2 parts of New Zealand chewings fescue and 1 part of Government Certified browntop, sown evenly at the rate of 1oz. of the mixture a square yard.

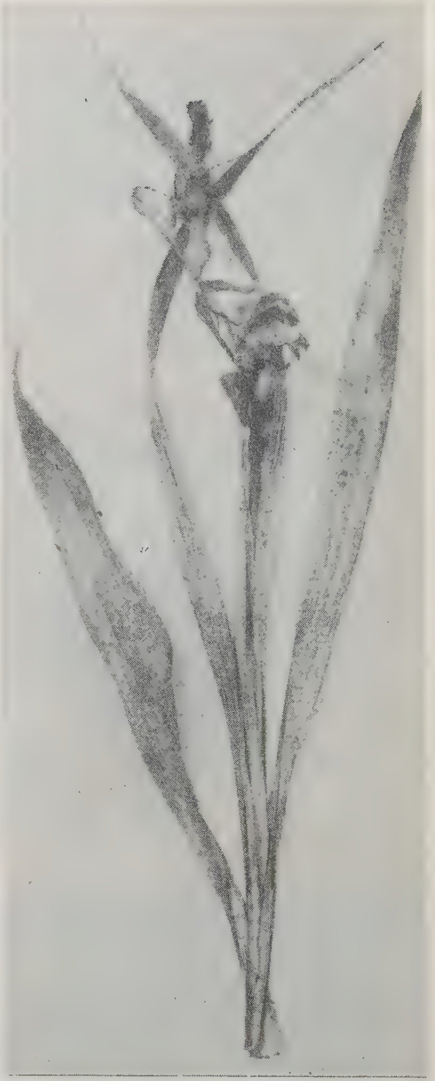
Lawn grasses which have suffered from wear or attacks by grass-grub or caterpillar will be showing bare patches. These should be forked carefully and lightly to break up the surface, and fresh grass seed should be sown as soon as the soil can be broken down to a fine tilth. The lawn should be given a topdressing of fertiliser in March to replace some of the plant foods removed during the growing season. A mixture of 3 parts by weight of sulphate of ammonia, 2 parts of superphosphate, and 1 part of sulphate of iron, applied at the rate of 1oz. per square yard, is recommended.

Shrub cuttings inserted in a frame in January should now be rooted and ready to plant out. If the cuttings are left for long in the frame after they have rooted, they become drawn and their crowded roots suffer severe mutilation when they are planted out. Rooted cuttings may be planted directly into their permanent positions, but are better planted 8 to 12in. apart in a nursery bed, where they can be left for another season before being planted out. In that way stronger bushes are produced, and they are less likely to be overlooked or injured when they are planted out among other and possibly larger ones in the border or shrub garden.

Violets can be made to flower through late winter and early spring in very cold districts if plants are lifted in March and planted in a cold frame. They should be dug up with as many roots as possible, to minimise the check of lifting, and watered in with a watering can fitted with a rose.

Pests and Diseases

Thrips infest a wide range of ornamental plants and, though not native to New Zealand, are widespread in gardens in the Dominion. The insects are very small, active creatures, with cigar-shaped bodies, yellow when young and black when adult. The adults have curious, narrow wings fringed with hairs and fly freely. Thrips scrape the surfaces of plants and feed on the sap, leaving characteristic silver scurf on foliage or flowers which they have attacked. This silver surface may later turn brown. Thrips can be controlled by spraying with nicotine sulphate solution (1 fl. oz. of nicotine sulphate to 4 gallons of water plus 2oz. of soft soap). The spray is more effective if 1 per cent. of summer oil emulsion is added. A second application should always be made about 14 days after the first to destroy young thrips which have hatched from eggs not killed by the first spray.



Thrips, which infest a wide range of ornamental plants, are widespread in New Zealand gardens. This gladiolus plant was ruined by thrips.

Tomato spotted wilt virus frequently attacks nasturtiums, the leaves of which show yellow mottles and spots which may almost cover the surface, while the plants become stunted. As nasturtiums frequently over-winter in mild districts, they can carry the spotted wilt disease from year to year. All nasturtiums which show mottling or distortion of the leaves should be pulled out and burnt.

"Woolly bear" caterpillars are the black, hairy larvae often found feeding on cinerarias, eating holes in the leaves. The adult stage of this insect is the magpie moth, easily recognised by its colouring of black with orange bands on its body and white spots on the wings. The caterpillars feed fully exposed on the leaves, so they can be controlled fairly easily by hand picking. A derris dust or a 2 per cent. D.D.T. dust can also be used to control them.

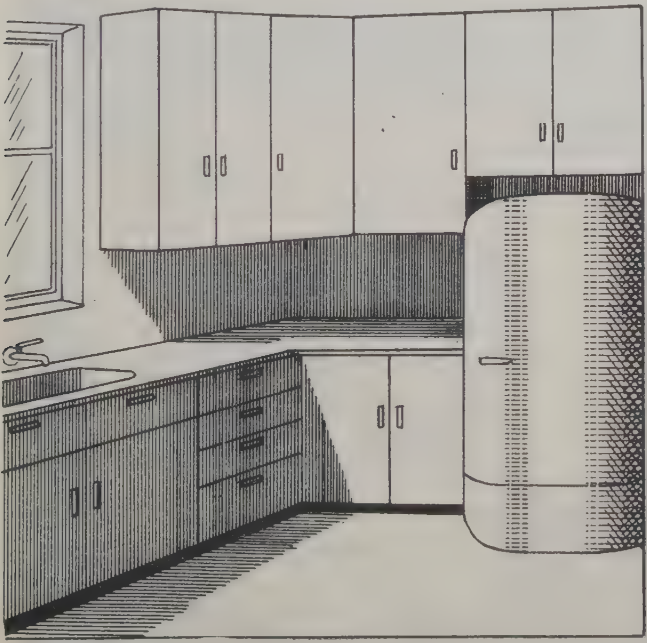
Household Refrigerators

By EDITH G. McNAB, Rural Sociologist,
Department of Agriculture, Timaru.

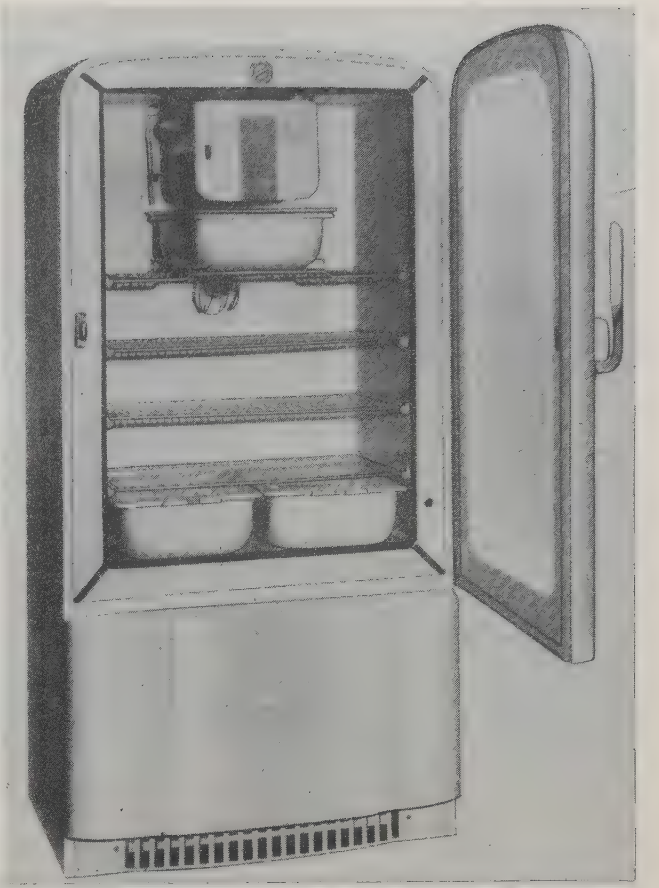
IN view of the fact that mechanical refrigerators became an item of household equipment only from about the 1920's the number in use today is remarkable. Their advantages in preventing waste, providing hygienic storage, and making it possible to supply the family with food in greater variety and in appetising form with fewer trips to the shops, are responsible for the increasing tendency for refrigerators to be classed outside the category of luxuries. This article gives information for those who desire to buy a refrigerator or who are new owners.

FOODS are spoilt by the growth of bacteria and moulds and by the continuance of the activity of the enzymes which cause ripening of fruits and vegetables and, if the process is not interrupted, eventually over-ripening. Refrigeration does not destroy any of these three completely, but it does retard their activity sufficiently to prolong the period for which foods may be kept. It should be noted that the growth of bacteria is only slowed down. They are not all destroyed by refrigeration. As food stored in a refrigerator does deteriorate, though more slowly than usual, it should not be kept there too long.

The refrigerator may be used to save labour; the housewife may make larger quantities of some foods at one time and keep them until required. For example, doubling the salad dressing recipe usually does not double the work required to make it. In warm weather it is much easier to keep the milk sweet by putting it in the refrigerator than by standing it in a bowl of water with damp muslin over the top or scalding it. The saving in money which results from preventing spoilage of foods and from buying meat in larger quantities will offset the cost of the refrigerator to some extent. In some conditions the saving spread over the lifetime of the refrigerator may be significant.



The preparation corner of a kitchen, showing the refrigerator at the right of the bench. Work would progress from right to left. Things may be taken from the refrigerator almost without moving from the bench, and its door opens from the left to make access easy. The bench beside the refrigerator is handy for putting things on when taking them to or from the refrigerator.



A 6.5 cu. ft.-capacity refrigerator.

Principles on which Refrigerators Work

The operation of a household refrigerator depends on the removal of heat from the food compartment and prevention of heat entering from the outside. Though refrigerators may be run by electricity, gas, or oil, by far the greatest number in New Zealand are electric, so the method of cooling is described as for an electric one. Heat is absorbed as liquids evaporate. Everyone who has noticed the cooling effect on the skin when it is wetted with liquids such as methylated spirits or petrol, which evaporate quickly, is familiar with this phenomenon. In household refrigerators the refrigerant is usually a gas, such as freon or methyl chloride, which is easily compressed to become a liquid at ordinary room temperatures. Such liquids change back to a gas very readily. The refrigerant is sealed within pipes, part of the system being outside, but the evaporator or cooling coil being inside the top of the cabinet. The liquid is allowed to evaporate in the cooling unit, absorbing heat from within the food compartment as it does so. The gas travels round to the motor-driven compressor, where it is subjected to pressure. The heat from compression is given off in passing through the condenser or heat-transfer coil, the result of the compression and cooling being that the gas returns to a liquid. The liquid circulates through the evaporator again and the cycle is repeated, the process being continuous while the refrigerator is in operation, so that heat is being absorbed, carried out of the cabinet, and given off to the atmosphere all the time. Thus the temperature inside the food compartment is reduced.

Thermostatic Control

The electric motor does not have to work continuously, as electric refrigerators are controlled by a thermostat, which will maintain a set temperature. Once the required temperature is reached the refrigerator is automatically switched off When the temperature becomes higher than the set figure the refrigerator switches on again.

Inside the refrigerator the air around the evaporator becomes colder and denser and so sinks down, pushing the warmer air up, to be cooled in turn. Solid shelves are not used in refrigerators, which have wire racks or trays which will allow the circulation of air currents. When the door is opened cold air is lost into the room and warm air enters, raising the temperature inside the refrigerator. To reduce power consumption and to keep the interior of the cabinet at the low temperature required for retarding the growth of bacteria on food the door should not be opened more often than necessary and it should always be closed as soon as possible after opening.

Insulated Walls

The walls forming a refrigerator cabinet are constructed so that the transference of heat from outside into the cabinet takes place very slowly; the ideal would be walls which do not permit the transference of heat. Insulating materials such as cork board, asphalted felt, or glass wool (glass wool or cork board are best) are used to fill the hollow walls. A rubber gasket round the door acts as an insulator and ensures a tight fit, so that when the door is closed cold air is not permitted to escape or warm air to enter.

Choice of a Refrigerator

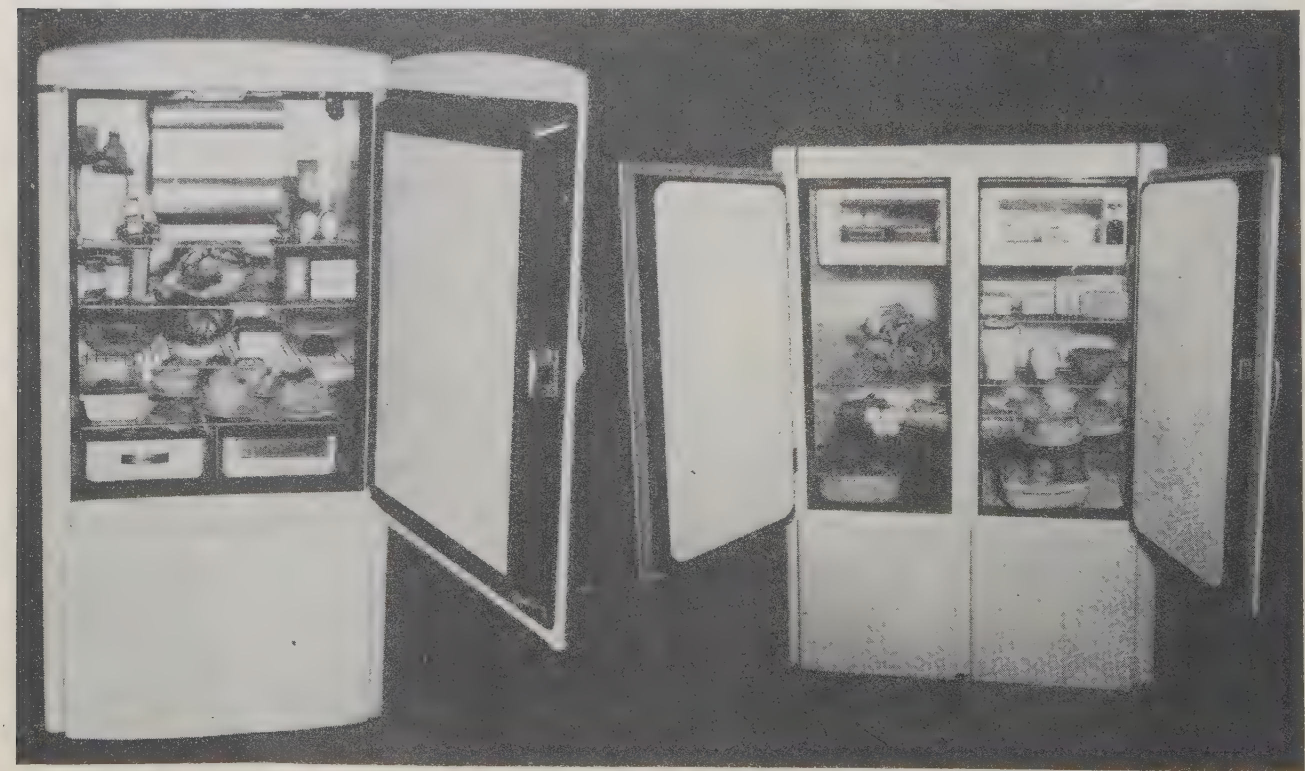
Too much specialised knowledge is required for most people to be able to learn to judge the mechanical efficiency of a refrigerator, but a guarantee gives protection; also it is wise to buy from reputable dealers and manufacturers. In operation a refrigerator should be reliable and quiet. The efficiency of the cabinet itself depends on good insulation and well-fitting doors. The fit of the doors can be examined and questions can be asked about the insulation. Servicing arrangements and details of any maintenance required should be investigated before making the purchase.

The capacity of the model chosen will depend partly on the size of the household and on any likely changes in its size. One rough guide is to allow a capacity of 6 cu. ft. for 2 people, adding 1 cu. ft. for each additional 2 persons. No rule can be given, as the most suitable size also depends on how much food is to be stored. The quantities of food obtained at one time will influence the decision on what size to buy. A farm household which kills its own meat or makes its own butter will be likely to need a larger refrigerator than a town household of similar size. The frequency with which food is bought or deliveries are made will influence the size chosen, because the quantities of foods bought depend to some extent on how often they can be obtained. One advantage of owning a refrigerator is that it becomes possible to economise in time and money by buying some perishable foods in larger quantities.

Shelves

The refrigerator should have sufficient slatted shelves to make full use of the space available. The slats should not be so far apart that small jars will tip when placed on the shelves. Adjustable shelves will help in making best use of the space. It should be possible to place tall bottles on one shelf. Some models have sliding shelves for easy access to foods, but such shelves should have a stop so that they cannot be pulled right out accidentally. Racks or narrow shelves on the door are useful for small things and help to ensure that the door is not kept open long. If much meat is to be kept in the refrigerator, a rail for hanging it on may be helpful.

Special compartments may be useful. Left-overs, salads, or sandwiches may be kept in high-humidity compartments without the housewife having to take the trouble of covering them. Quick-freeze compartments, which will store commercially frozen foods or will freeze small quantities of fresh foods, increase the possibility of preparing foods ahead of the time they are required for use, so may be a convenience for a busy housewife. The disadvantage of a quick-freeze compartment is that the running costs are increased, because the temperature in the compartment is kept at either 0 degrees F. or from 10 to 15 degrees instead of the 40 to 50 degrees of the refrigerator, so that more power is used. (At 0 degrees many foods may be kept for months; at 10 to 15 degrees for about a month.)



Left—A 7.4 cu. ft.-capacity refrigerator. Meat is placed directly under the cooling unit, and bottles and bowls are covered. Right—A 12 cu. ft.-capacity refrigerator with a small frozen-food compartment in which commercially frozen foods may be kept.

Covered containers suitable for storing food in refrigerators. Square or oblong containers are more economical of space than round types. An egg holder is shown at left.

Shape and Size

The shape and size of the refrigerator may influence choice. If the top is rounded no clutter can accumulate there, but a flat top may be handy for placing things on when putting foods in or taking them out of the refrigerator. For small kitchens or a small family a low refrigerator with a counter top will take up less space and add a work surface, though it means more stooping to put in or remove foods. Such refrigerators are less generally available in New Zealand than the tall cabinets. There may not be space in the kitchen for a large refrigerator. Notice which way the door is swung; when the refrigerator is in position the door latch should be at the side next to a bench or table so that things may be put in or taken out quickly without having to reach round the door. This point does not apply to the large sizes having narrow, centre-latching doors.

Cleaning

Ease of cleaning is important to the housewife. Corners should be rounded, there should be no crevices, and the inside and outside surfaces should be smooth porcelain enamel. Metal fittings should be rust-proof and should be easily cleaned. If the refrigerator does not stand flat on the floor, there should be enough space for cleaning underneath.

It is a convenience to have a release fitted to the ice-cube tray. Some refrigerators have an inside light operated by the opening and closing of the door. A fairly new development is automatic defrosting. In comparing prices it must be remembered that all extra fittings and gadgets add to the price. Their worth in extending the use or adding to the conveniences of the refrigerator should be assessed carefully and set against the increase in price or running costs. It may be better to choose a refrigerator which carries out its fundamental purpose well, without any "sales" features.

Installation

The refrigerator is best placed near the storage cupboards so that a storage-preparation-cooking sequence can be followed in meal preparation without retracing steps. The number of door openings can be reduced by having some counter surface next the refrigerator, as then all the things required for a meal or all to be put back after use can be assembled and dealt with at one opening. This bench is best at the side of the refrigerator on which the door opens.

The refrigerator should be handy to the dining table if this is compatible with convenient use in the kitchen, because frequently foods or beverages are taken directly from it to the table. Choose a cool part of the room for the refrigerator and see that the floor is level. The condenser is usually below the refrigerator, with provision for ventilation at the back. Allow about 2½in. between the back of the cabinet and the wall and 8 to 12in. above it so that the warmth given off from the compressor can be carried off by air currents.

Use

Household refrigerators usually maintain a temperature of about 40 and not more than 50 degrees F. In some models the temperature may be adjusted. The temperature range is low enough to keep foods wholesome longer than if they were exposed to ordinary room temperatures and the loss of vitamins from foods is less than in those stored at higher temperatures.

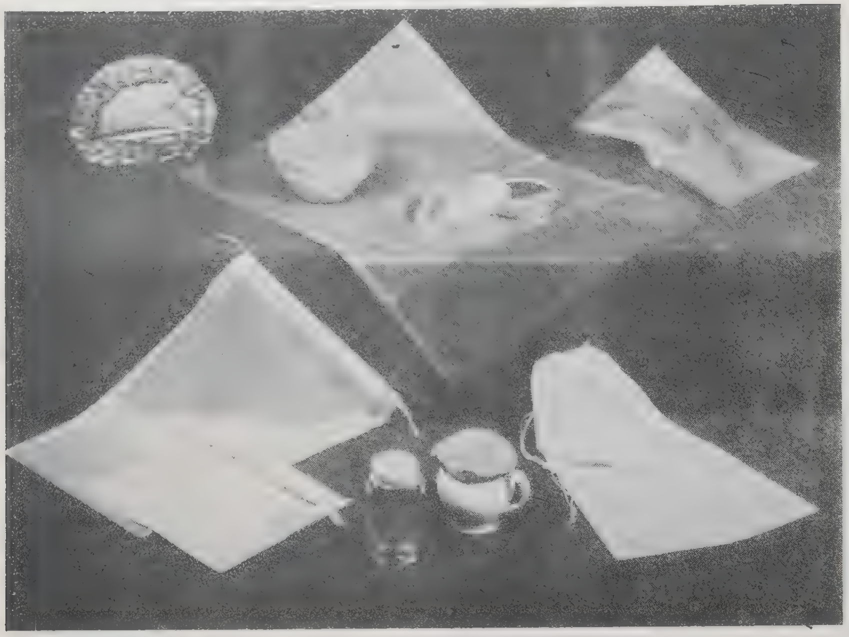
For economical operation there should be as few door openings as possible. Whenever the door is opened warm air enters the refrigerator and extra work has to be done to cool it, which increases the power consumption. It has been shown that after six openings of the door of a typical model of household refrigerator it took 1½ hours to bring the temperature back to the set figure. Another significant fact is that two door openings each of 30 seconds will cause a greater rise of temperature than one opening of 60 seconds.

Hot food should not be put in the refrigerator, but should be cooled to room temperature first. It is wasteful to have in the refrigerator foods which are not perishable.

If for any reason the control is set to a lower temperature than usual, it should be returned to the usual setting as soon as possible, as operation at the lower temperature increases the power consumption enormously without a corresponding increase in the length of time foods may be kept.

Another point to be remembered in putting foods into the refrigerator is that the air must be allowed to circulate, as it is the flow of cold air from the expansion unit which cools down the whole of the interior of the refrigerator. Shelves should not be covered from wall to wall with a solid tray or arrangement of food; spaces must be left to allow free movement of air.

HOUSEHOLD REFRIGERATORS



Plastic bags, suitable for vegetables or irregularly shaped solid foods, and bowl and jar covers.

As the air in a refrigerator becomes dry because of the removal of water vapour from it by freezing, the circulating air, though cold, dries the surface of many foods, particularly cooked foods and some vegetables. Also moisture from foods will cause more frost to form on the cooling unit. Covers are used to prevent this. Square or rectangular glass or plastic containers with lids are useful for keeping foods covered and are economical of space on the shelves, while plastic or wax covers can be used on bowls. In high-humidity compartments food may be left uncovered, as the drying effect there is less.

Treatment of Various Foods

Foods with poor keeping qualities, such as dairy products or meat, are best placed in the coldest part of the refrigerator, which is just below or very close to the expansion unit. Raw meat should be left uncovered, but cooked meat needs a cover to keep the surface from drying.

Tainting of other foods by strongly flavoured foods may be minimised by using covered containers for the latter, though only a sealed container will prevent any exchange of odours. Fish should be covered tightly to reduce the risk of other foods acquiring its flavour.

Eggs can be placed in a wire basket or tray near the middle of the chamber and fruits should be taken out of bags and left loose on trays or in open utensils. Oranges and apples may be left in individual tissue papers. The flavour of some fruits, for example, peaches, is destroyed if they are left in too long, and to develop full flavour most fruits should ripen outside the refrigerator. Bananas blacken when stored in a refrigerator.

Leafy vegetables are best washed and covered before being placed in a refrigerator. Plastic bags are useful for covering them if a sufficiently large dish is not available. Celery after being washed can be placed in a covered jar, while asparagus may be stood upright in a shallow dish with a little water in it.

Left-over foods should be covered. It is best to set gelatine dishes out of the refrigerator and then put them in to chill until needed. Setting may be hastened by cooling the warm gelatine mixture in the refrigerator, but if this is done the jelly will soften quickly when it is removed for use.

Care of Refrigerator

Water vapour from the air in the refrigerator collects on the expansion unit as frost, thus insulating the unit and making cooling of the contents of the refrigerator slower, and the motor has to work longer to maintain the set temperature. When the frost becomes ⅛in. thick defrosting is recommended. It should not be allowed to become more than ¼in. thick. Defrosting, which is not likely to be necessary more than once a week, may be done overnight by turning the power off and leaving the refrigerator door closed. Defrosting can be done during the day by switching off the refrigerator, removing all food, ice trays, racks, and shelves, and leaving the door open. The frost will take about an hour to melt. Make sure that the defrosting tray is under the cooling unit, and as the water from the frost will have absorbed food odours, empty it out after defrosting.

Cleaning can be done conveniently immediately after defrosting, though the outside of the refrigerator may be cleaned at any time. The outside, rubber door gasket, trays, racks, and shelves should be washed in hot soapy water and rinsed with fresh hot water before being dried, but rubber ice trays should be washed in warm water only. Avoid using abrasives on metal ice trays, as any roughening of the surface will tend to make the ice cubes stick. Do not use abrasives on the enamel. All this cleaning can be done while defrosting is in progress, leaving only the inside to be done when the frost has melted. Use a lukewarm solution of 1 tablespoon of baking soda or borax to 1 quart of water to wipe out the inside, including both inside and outside of the cooling unit. Rinse the inside portion with fresh, lukewarm water and dry it thoroughly. Anything spilt inside the refrigerator between cleanings should be removed at once. Acid foods should not be left in contact with any part of the refrigerator.

Gasket, Catch, and Hinges

Outside metal parts of the refrigerator can be polished with a soft dry cloth, though if other treatment is required, silver polish is safe. The gasket should not be allowed to come in contact with greasy food or oil, because such substances cause rubber to deteriorate. If the surface of the rubber tends to stick, a dusting of talc will help to prevent it holding. The fit of the gasket can be tested by placing a slip of paper in the doorway as the refrigerator is closed; if the paper can be pulled out when the door is shut, the latch needs adjusting or the gasket requires replacing. The catch and hinges will require occasional lubrication, for which light oil can be used or, if desired, graphite powder for the hinges. The catch should fasten easily and it should not be necessary to slam the door. Scratches in the enamel may be touched up with enamel paint applied with a small brush.

Heat-transfer Coil

The heat-transfer coil at the back of the refrigerator will need periodic dusting, as a layer of dust acts as an insulator and slows down the giving off of heat. Turn off the power and dust the coil with a brush or the dusting attachment of the vacuum cleaner. If the motor is sealed in, it will require no attention from the housewife, but a motor of the open type may need oiling and this should be ascertained before the refrigerator is bought.

When a refrigerator is to be turned off and not used for a period it should be emptied, cleaned, and left with the door ajar. Some makes require some attention to the valves before being used again. This point, too, should be investigated before the equipment is bought.

Important Points

Important points in the use of a refrigerator are:—

Defrost regularly.

Open the door as infrequently as is possible.

Keep the refrigerator as much as possible at the normal temperature setting.

Do not put hot foods in it.

Use it for perishable foods only.

THE MUSEUMS OF NEW ZEALAND

A DESCRIPTION of the exhibits of another museum in New Zealand is given below in a further article in this series by Enid B. V. Phillips. This month she discusses the collection in the

Old Colonists' Museum, Auckland

THE Old Colonists' Museum, Auckland, is situated in the same building as the public library and art gallery and was officially opened on March 22, 1916. The founder and director of the museum, John Barr, O.B.E., is also chief librarian and his extensive knowledge of Auckland history has enabled him to compile an extremely comprehensive volume on the subject entitled "The City of Auckland".

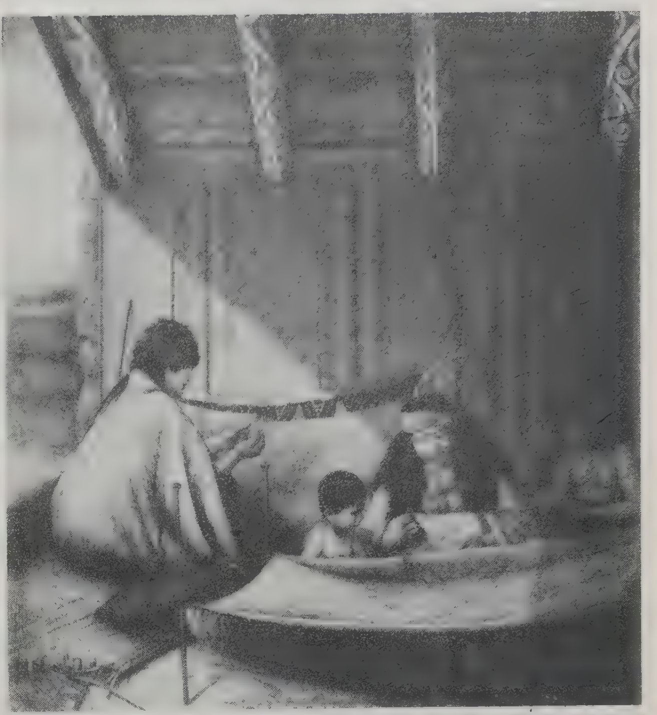
One of the most interesting exhibits in the museum is an armchair by the window of one of the spacious upstairs rooms. Although old, the chair with its square of smooth, slippery leather for a seat, its spindly teak framework and its slender arms curving out a trifle at the ends cylinder-fashion, appears far too frail for the purpose to which it was put, that of lowering Mrs. John King, the captain's daughter, and her lady companion from the brig Active on the occasion of the Rev. Samuel Marsden's first visit to Oihi, Bay of Islands, on December 22, 1814.

Presumably both ladies were of small build or the captain would not have permitted the use of such a chair; certainly it was not designed to support a very portly person even on the ground, let alone suspended in mid-air from the side of a ship. Whether the two passengers themselves experienced any misgivings about their means of conveyance is not known, but the landing was effected without mishap and John King, who had been a shoemaker before Marsden recruited him for service with the Church Missionary Society, duly commenced his duties as catechist for the Bay of Islands district. A few years later he and his wife undertook a trip to Hokianga, being the first pakeha couple to visit this locality. Hannah King's calf-bound hymn book, inscribed in her handwriting and with its covers worn by much handling, has been preserved beside her husband's Bible (on the fly-leaf is his name and the date, August 3, 1811), his "Selection of Psalm and Hymn Tunes", a thick, oblong volume compiled by John Rippon, and the slate he used in the first Maori Mission School at Te Puna.

Relics of Richard Davis

Among the relics of other missionaries associated with the early activities of the Church Missionary Society in this country are those of the Rev. Richard King Davis, the self-educated son of a Dorset farmer. Always an ardent agriculturist, he caused the land wherever he was stationed to "blossom like the rose", and his farm at Waimate North won high praise from Charles Darwin. The oak tree which grew from an acorn Mr. Davis planted at Paihia and which he transferred some years later to Waimate North when he went there to live still flourishes Here, in a glass case, are displayed his stole, his silver pencil and penholder, his leather-covered flask, his stone mortar and pestle, the flute whereon he accompanied the hymns aboard The Brothers, the ship in which he and his family sailed from England in 1823, the wooden mere presented to him shortly after his arrival in New Zealand, his slate, cracked across the middle but with the frame still intact, and a blue bowl embellished with cabbage roses and kingfishers which was used in the Te Puna Church for baptismal services. A little claw-legged lacquer tea caddy gilded with willows and Chinese pagodas and an ivory fan threaded with narrow blue ribbon are romantic reminders of the feminine members of his family.

The pretty pink, blue, and green designs on some of Mrs. Davis's plates are still clearly defined, but time has subdued the colours on her sampler to somewhat nondescript hues. She cannot have had much leisure for fancy-work at the time of her husband's ordination, for he was put in charge of a northern circuit, entailing considerable travelling; moreover, the marriages of two of their daughters took place that year, Jane wedding the eldest son of Archdeacon Henry Williams and Serena the Rev. H. F. Butt. Thus both girls followed their older sisters' example in marrying missionaries.



[From the Alexander Turnbull Library photographic collection.

This outstanding picture of three Maori women weaving, which is in the Old Colonists' Museum, Auckland, was painted in 1905 by the Bohemian artist Gottfried Lindauer, who spent many years in remote parts of New Zealand to portray the Maori people and their mode of life.

Delicacy of Taste

A few of the personal possessions of Francis Ann Goodwin, the wife of one of the Davis sons, James, are here too; her tall tortoise-shell comb and tiny jet ear-rings, ivory patch box with its green, silk-lined lid and medallion holding a lock of hair, slender glass perfume phial gilded in diamond patterns, ruby-coloured vinaigrette with engraved silver ends monogrammed to match the accompanying scent bottle, and small, heart-shaped silver flask for her favourite flower-fragrance all denote her delicacy of taste. Even such practical items as needles and bodkins were kept in a tiny silver case, and her crochet hook had a separate silver holder and her scissors were sheathed in silver.

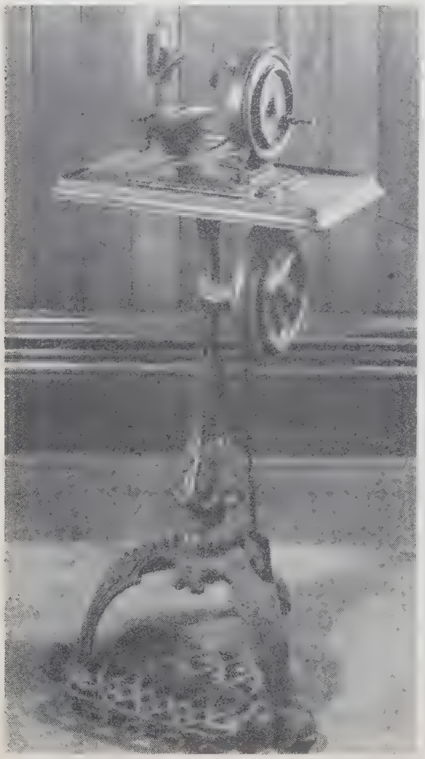
She wrote her memoranda on message tablets of ivory and carried her housekeeping money in a circular, gilt-topped purse prettily beaded with leaves on a lavender background. Furthermore, this young woman had a passion for fans and possessed a varied array made of all manner of materials, from soft-curling ebony feathers that showed a faint emerald sheen in the firelight and that were hand painted with roses and a tropical bird to the ever-fashionable ivory, fluted and flower adorned, and from the filmiest black lace and sateen to sturdy ivy leaves of green linen, the base being carved from wood.

Artistic Needlework

Though there is no record of the personal history of Elizabeth Jones, the needlework of this 14-year-old girl shows that she was artistic, industrious, and gifted with her needle. She must nave possessed exceptionally good eyesight, for all her designs were done in silks in minute cross-stitch on the finest of canvas. Beneath the injunction "Seek ye the Lord while He may be found" she had embroidered a house and trees, birds and dogs, twin urns of flowers, and. last, an apple tree of such perfection that it might well have belonged in the Garden of Eden.

Biblical subjects were undoubtedly popular among the youthful needlewomen of those days. One masterpiece in

THE MUSEUMS OF NEW ZEALAND . . .



[*Sparrow Industrial Pictures Ltd. photo.*
This sewing machine, with ornate treadle and tall three-legged iron stand, was brought to New Zealand in 1884 and used for many years by the late Mrs. J. Brown, of Auckland.

coloured wools depicted a group of Jewish captives weeping by the waters of Babylon. The despair of the young mother and the misery of the musician whose lyre cannot console him in his exile are expressed with remarkable realism through such a difficult medium. The tall, walnut-framed pole screen, with its bouquet of bronze-beaded leaves, cream lilies, and crimson roses of clipped, tufted wool glowing against a background of black petit point, would grace the most elegant drawing-room and was the work of Mrs. Mary McDonald, daughter of Alex. Marshall, who attended the first Government land sale in Auckland.

Captain Cook's Bowl

Probably one of the most valuable exhibits is a bowl which once belonged to Captain James Cook. This domestic link with the famous navigator was purchased by Lady Samuel, wife of an Agent-General in London for New South Wales. Housewives whose cherished china has suffered at the careless hands of hired help will sympathise with Lady Samuel, for a servant dropped the bowl and broke it. However, the person entrusted with the responsibility of repairing it was so skilful that the intricate network of joins is apparent only if the bowl is inspected closely.

Other pieces of china on display include a large oval meat dish rimmed with a blue and white rope design and bearing the stamp of the Panama, New Zealand, and Australian Royal Mail Company, which was dissolved in 1869; two mantel ornaments, a white and rust pekingese and a bonny Scots lassie resplendent in tartan, scarlet boots, and plumed hat; portions of a willow pattern dinner service; and a fat, brown teapot decoratively ringed with concentric grooves that had been brought to Sydney in the Royal Admiral in 1838 and thence to New Zealand in the Nimrod.

Another much-travelled teapot, the property of a passenger on the Jane Gifford, one of the principal immigrant-carrying vessels in the 1830's, is of pewter with a spout shaped like a swan, a gracefully curving handle, and four pewter leaves forming a little stand at the base. The round wooden toddy ladle and the heavy glass salt cellar petalled like a passion-flower are also products of the Old Country, but the horn spoon was fashioned by a settler at Muddy Creek, Titirangi, and a cooper who came out to New Zealand in 1859 by the poetically named ship Spray of the Ocean made from bush timber a pleasingly proportioned high chair for a child.

Rigours of Pioneer Life

The lot of the women pioneers was often arduous in the extreme and very different from what they had been accustomed to, yet they still maintained standards of dress and decorum as became gentlewomen. This is shown by the exhibits of a pair of black lace mitts, a sovereign purse crocheted in beige and crimson silk, slender bone glove stretchers, and a blue taffeta-lined glove box which are arrayed alongside such mundane articles as a candle mould, wool and thread winders, a goffering iron, and a cowbell the wearer of which was called Echo.

Descendants of Mrs. Francis Tapp, who arrived in Auckland on September 17, 1849, by the troopship Oriental Queen, have donated a number of interesting heirlooms to the museum; these include a pair of gold crescent ear-rings, several exquisite brooches (one, of silver, resembles a pansy; another is wreathed with gold leaves), a red glass vinaigrette, a long silver chain and an elaborately engraved locket the size of a pocket watch, and a dressing-table set of rose-sprigged china complete with perfume bottle, pots for beauty preparations, and a tiny "tree" to hold milady's rings.

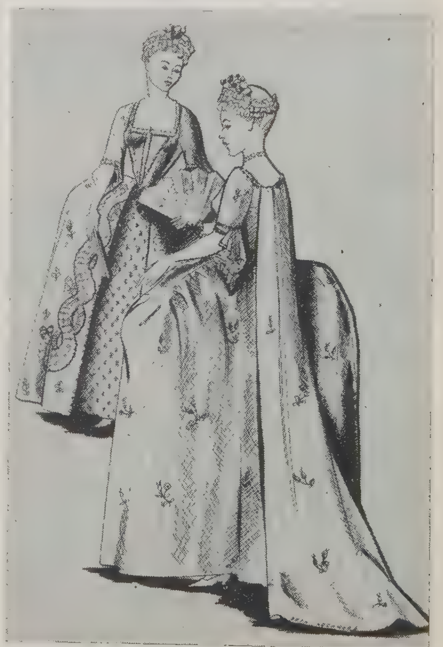
Mr. Tapp's silver cuff links are there, too, in company with sundry other masculine belongings such as the clothes brush Jesse Pip [illegible] had at the Battle of Waterloo, two umbrellas brought from England in the 1830's by a clergyman, a silver lever watch with Roman numerals and a crimson enamel signet fob initialled in gold belonging to a passenger on the Bungalore, the barque which conveyed Captain Robert FitzRo [illegible] the second Governor, to the colon [illegible] and a pen-wiper made from a s[illegible]let uniform belonging to one of th[illegible]nglish regiments which served in [illegible] Maori Wars.

Mrs. Tapp was evi[illegible]y fond of sewing for she had tw[illegible]ady's companions". One was [illegible]ed leather ornamented with gold [illegible]ling and it contained a silver thimble and a pencil with a cairngorm top, scissors and stiletto, buttonhook and bodkins, and a violet inch-tape. The other, of brown leather, was equally well equipped and boasted a mirror inside the lid and a tiny blue tape measure in an acorn-shaped case. Tucked away in a back compartment were two green tablets pencilled with the names and ages of various dead relatives, including 5-year-old Master James Francis Tapp, who died on April 3, 1874.

Old-fashioned Sewing Machine

The sewing machine, with its solid iron table and wheel, which made its first appearance in New Zealand in 1884, is exceedingly cumbersome in comparison with Mrs. Tapp's dainty sewing aids, yet it represented a considerable advance in the lightening of women's labours and enabled its much-envied owner to "sew a fine seam" with the minimum expenditure of time and effort. And seams there were aplenty in the dresses of the day, as evidenced by the elegant examples in the museum.

Even a simple street frock of peacock-blue taffeta in the 1870's featured scalloped lace flounces and a full skirt sweeping into a slight train, the coatee being braided and buttoned as well as fastened by minute hooks and eyes. Trimmings became increasingly ornate during the next decade; for example, a black satin skirt embossed with arum lilies and bound with black velvet was attached to a whalebone-stiffened bodice having pintucks, heavy jet embroidery, and



Two views of a striped ottoman silk court dress worn in the reign of George III and which is now in the possession of the Old Colonists' Museum. The incredibly small waistline is accentuated by the wide side panniers. The loose hanging pleats shown in the back view went out of fashion after 1775.

[*Sparrow Industrial Pictures Ltd. photo.*

Three exhibits in the Old Colonists' Museum. On the left is the historic armchair used to lower Mrs. John King from the brig Active on the occasion of the first visit of the Rev. Samuel Marsden to Oihi, Bay of Islands, on December 22, 1814. The child's high chair was made from bush timbers by Mr. E. Hocken, a cooper who arrived in Auckland on May 1, 1859, in the vessel Spray of the Ocean. The colourful wool and beadwork of the handsome pole screen on the right typifies the skill of the gifted needlewoman Mrs. Mary McDonald.

velvet ribbon bows and with a pleating of soft cream silk at the neck.

Sophisticated Dress of Young Girls

Small girls were dressed like miniature editions of their mothers. A typical frock made for a Wellington 9-year-old in 1880 had an accordion-pleated overskirt of lavender-blue taffeta, a diminutive bustle defined by a large plush bow, and long sleeves with frilled lace cuffs falling from a wide wristband of purple plush; the velvet vestee had a plain piece of taffeta down the front to set off a row of round purple buttons surmounted by silver blossoms. Babies' attire was rendered brighter by the addition of a double cape of finely woven crimson serge bordered with silk and quilted in a flower pattern, the tiny silk collar having white ribbon ties.

Grey silk poplin seems to have been the popular choice of brides of that period, for there are at least three wedding gowns of this material in the collection. One is in military style, with waistcoat, watch pocket, and long coat tails, the only concession to femininity being a fringed bow at the back and a boutonniere of orange blossom and lace in the lapel; another, the complete antithesis of the first, has an attractive bustle, scarlet-beribboned three-quarter sleeves, and an underfrill of pleated lace and muslin peeping coyly from beneath the hem; and a third has the central back panel of the skirt draped to resemble the waves of the sea, an effect accentuated by the silvery-grey shimmer of satin fringing elsewhere on the gown.

Earlier Wedding Gown

The taffeta wedding dress the colour of moonlight is of a considerably earlier period, being worn by Mary Richardson in 1826 and brought to New Zealand by her daughter Janet in 1862, and consequently is of a much more simple design. Sprigged with pink carnations and delicately striped with palest leaf green, the silk is admirably suited to puff sleeves, an off-the-shoulder neckline, and a high waist drawn in to little-girl slenderness by a blue ribbon trimmed with minute rosebuds.

The plumed poke bonnet which framed the face of Mary Ann Williams when she landed at Russell, after travelling from Bristol to New South Wales and thence with Marsden's band of missionaries to New Zealand belongs to this period, as does a brown floral frock with a net fichu and leg-of-mutton sleeves. (Mary Ann's courtship was a short one, her marriage to the Rev. James Preece, a fellow-worker for the Church Missionary Society's cause, being solemnised in the chapel at Kerikeri "by Banns this Twenty-fifth Day of January, in the Year One thousand eight hundred and thirty-three. By me Alfred N. Brown", to quote the quaint wording of the official record. The Rev. (afterwards Archdeacon) Brown was appointed missionary in charge at Tauranga, where he served for 46 years until his death, and Mr. Preece pioneered the Hauraki work).

The Paisley gown was given to Mrs. Preece by Lady Franklin in 1847, the girlish white muslin adorned with brown gimp having graced the wardrobe of the missionaries' daughter Harriet, the baby referred to by Serena Davis in her letter of October 3, 1834, to Mrs. Preece: "I sincerely congratulate you on the birth of your little daughter, and it is my earnest prayer that she may be spared to you and grow in grace as she grows in years". She ended her epistle with the charming postscript: "Kisses in abundance for your sweet babe".

The Preeces' first-born also had the distinction of having as nurse the beautiful A-o-tu-i-ata, a paramount chief's daughter, who helped to start the mission station at the Puriri settlement (situated a few miles south of Thames) and was henceforth a privileged member of the missionaries' household.

Striking Waistcoat

A flowered silk waistcoat affected by a Victorian bridegroom is a striking garment and is one of the many family heirlooms left to the museum by the late Miss Marnie A. Spicer.

The recent donation of a court dress which made its first appearance in the reign of George III has added further lustre to the collection of period costumes. The oyster-shaded, striped, ottoman silk saque is fashioned with a narrow-pointed bodice, elbow-length sleeves which fall into three fan-shaped flounces, and loose hanging pleats at the back and the skirt opens in front to disclose a lozenge-quilted petticoat of ivory satin. In the days of powder and patches the side panniers were supported on a short-hooped petticoat which was later superseded by a metal frame so constructed that each side could be raised to enable the wearer to pass through a narrow space without walking sideways. The gown has lavish chenille embroideries of daisies, moss roses, and true lovers' knots in shades of coral, amethyst, amber, jade, and gold.

When circumstances permit it is hoped to build up this collection of bygone fashions in the Old Colonists' Museum still further so that present and future generations may see even more of the colourful garments of the women who played such an important part in the pioneering history of the Auckland Province.

CARE OF

This worker has assembled around her all the equipment needed for shampooing a carpet—basins of shampoo, warm water, and vinegar water, cloths for each bowl, a brush for the shampoo, and a dry cloth for rubbing the carpet dry.

CARPETS are available in New Zealand shops in greater numbers and variety than for many years, but are no less expensive than formerly. To give its full value in years of service a carpet needs looking after carefully, and that means treating it properly from the time it is being laid. There are good and bad ways of laying a carpet, there is adequate and inadequate daily and weekly care, and every few years the owner of a carpet is faced with the necessity of giving it a thorough shampoo or of having it dry cleaned commercially. Dry cleaning is expensive, but shampooing can be done at home and, if it is done properly, can be quite successful, though it would probably be wise to have a really valuable carpet always dry cleaned commercially. The care and cleaning of carpets are the subject of this article by Eirene E. Unwin, Rural Sociologist, Department of Agriculture, Dunedin.

The first stage: Applying the shampoo over a small, even-shaped area.

WHEN a carpet is being laid great care should be taken with the underlay, which may be of felt, old carpet, newspaper, or brown paper. It should be quite smooth. If the floor is uneven, as it sometimes is in an old house, the irregularities can be filled in by carefully fitting layers of paper, and time and care spent in doing this will be well repaid in longer life for the carpet. The underlay should be thick and if possible resilient or slightly springy, so felt is probably the best of the materials suggested. Sponge rubber is better still, but its use adds to the cost considerably. The thicker the underlay the better will the carpet wear and the more luxurious will it feel to walk on. The underlay should be slightly smaller than the carpet.

To deter moths the underlay may be sprinkled or sprayed with a moth preventive or, if this is not available, covered with newspaper, which they dislike.

If the carpet is to be fastened down, special carpet tacks should be used, not driven in so far as to make a pronounced hollow in the pile. Tacking is better avoided if possible, and when the carpet is to be lifted the tacks should be prised up from underneath the carpet, not from beneath the head of the tack on top of the carpet.

Minimising Wear

If a carpet can be turned round every year or two so that parts which have been under furniture replace parts which have withstood traffic, it will be worn more evenly. With a wall-to-wall carpet made up of strips that is not practicable, and scatter rugs or an extra strip used as a runner may be placed on top of the carpet along the lines of frequent traffic; these should be heavy enough not to wrinkle or curl up at the corners, or they may become quite dangerous.

The legs of furniture tend to wear carpets badly, but only in small areas. Such wear can be minimised by using fairly broad castors on all furniture that has to be moved frequently and by placing the legs of stationary furniture in glass or earthenware cups which are sold for this purpose.

Heavy furniture should never be dragged across a carpet. The help of several other people should be enlisted and the furniture lifted.

Daily and Weekly Cleaning

A carpet sweeper or a brush is best for the daily cleaning of a carpet unless the room is much used, when a vacuum cleaner may be necessary.

The work should always be done in the direction of the pile, as working against the pile brushes dust into the carpet, not out of it and considerably shortens its life. Light brushing raises the minimum of dust.

A vacuum cleaner fitted with a flat metal nozzle is best for the weekly cleaning again in the direction of the pile Clean underneath the edges of the carpet unless they are tacked down. As a carpet sweeper picks up threads better than a vacuum cleaner, it may be necessary to use it after the cleaner.

If a vacuum cleaner is not available, a good sweeping will be necessary weekly, and first sprinkling washed tea leaves or wet torn newspaper over the carpet helps to lay the dust. The tea leaves or newspaper are then swept off in strips into a dustpan. Upholstered furniture should be covered before the carpet is swept, even if tea leaves have been used, for only a vacuum cleaner removes the dust from a carpet without shaking some of it into the air.

Keeping Moths Away

Even a carpet in a room that is seldom used should be cleaned thoroughly about once a week to remove dust settled out of the air and to get rid of moth eggs. Large pieces of furniture should be moved, or at least cleaned under, for moths like nesting in dark corners. An insecticide may be sprayed occasionally under pieces that are too heavy to move easily or are not on castors, but if babies are likely to be crawling over the carpet, an insecticide non-poisonous to humans should be used.

If a wall-to-wall carpet has been turned under at the edge to fit the room, the fold should be opened out and cleaned with a vacuum cleaner every few weeks, as it too is a favourite nesting place for moths.

CARPETS

Shampooing

Shampooing is not necessary every year, but only when the carpet is too dirty with accumulated grime to be tolerated longer. Shampooing must be done carefully or it will leave the carpet in a worse condition than before.

A felt carpet cannot be shampooed, as it would stretch and wrinkle out of shape. A powerful vacuum cleaner should be used instead. The felt should not lift if it has had several years of use and is well trodden down.

The chief points to remember when shampooing a carpet are:—

The carpet must not be allowed to become too wet, for dampness rots the backing.

The soap must be rinsed out thoroughly, for a film of soap left on the pile picks up dirt again readily.

The carpet should be dried quickly, so a warm, windy day should be chosen and work begun early so that it may dry as much as possible the same day.

The first step is to get rid of as much dust as possible by a thorough brushing. If the carpet can be lifted, it can be taken outside and brushed on both sides. It should not be beaten unless it is very dusty, as beating tends to remove some of the filling of the carpet and may break the backing fibres so that the pile becomes loosened and may come out in time. If necessary, the carpet may be laid upside down on the grass, beaten lightly from the back, then turned over and the loosened dust brushed off, this process being repeated until no more dust comes out.

The underlay should be taken outside and swept or cleaned with a vacuum cleaner, and the floor washed before the underlay is replaced.

If the carpet cannot be lifted and the sweeping has to be done inside, all dust must be allowed to settle and then be wiped off the wainscot and other ledges. When there is no suspicion of dust in the air of the room the shampooing may be begun, but not before, or dust will adhere to the wet surface.

The shampooing may be done outside with the carpet laid on a flat area of concrete, or on a lawn if the grass is quite dry; or it may be done inside with the carpet laid on the floor again if it has been removed for sweeping, or on a table if the carpet is small enough.

If it is intended to dry the carpet outside, the underlay need not be replaced until later, but if the carpet is to be shampooed and dried in position, the underlay must be replaced first. Treating it with moth repellant again is a good idea. The underlay should not be put down until the floor is quite dry.

To make the shampoo, dissolve soap flakes or a neutral bar soap (not ordinary laundry soap) in hot water, making the solution as strong as possible. When it has cooled a little whip it to a foamy lather and add a little ammonia and borax (1 tablespoon per quart). Alternatively, a good carpet shampoo may be used. (The soapless detergents made from petroleum are particularly good and instructions for their use are given on the next page.) Also needed are several soft, non-fluffy cloths and, if the carpet is very dirty, a small, soft brush (an old nail brush does quite well); several bowls of clean warm water, and one of vinegar water (1 tablespoon of vinegar to a quart).

Begin the shampooing in one corner and work on only a very small area at a time. Rub the lather on with a cloth or the brush with a circular motion. Use only the lather, not the water below it, or the carpet will become too wet. Then with another cloth wrung out of clean water wipe off the soap. Continue this rinsing with cloths each wrung out of a fresh bowl of clean water until no soap is left on the carpet, and finish off with a cloth wrung out of the vinegar water. Finally rub the carpet as dry as possible with a dry cloth and rub up the pile by combing it with the fingers.

Then lather the next area, and continue working in strips, each overlapping the edge of the previous one; that is the only way of ensuring that no parts are left unwashed and that no "high-water marks" are made. Continue this lathering, rinsing, and drying over the whole carpet, renewing the water as soon as it becomes dirty.

The second stage: Wiping off the shampoo. Cloths wrung out of clean water are used until no soap is left on the carpet, then a cloth wrung out of vinegar water, and finally a dry cloth.

The carpet must not be made really wet. At no time should the backing be even damp. To ensure this use cloths that are well wrung out, use only the lather, and work on quite small areas so that each may be completed and dried quickly.

No one should walk on the carpet until it is quite dry. So that it shall dry as quickly as possible, when shampooing is completed either leave the doors and windows open and light the fire to dry the carpet in the room, or take it outside and throw it over the line or, better, spread it over two lines, right side out, and move it occasionally as it dries so that the lines do not make creases.

The carpet may take a day or two to dry out completely and if the room is shut up too soon, a musty smell may develop. Therefore it is probably best at least to finish drying it outside. An hour or two in a good warm wind should finish it off quite well. Because of the necessity of thorough drying shampooing carpets in winter is not advisable. A warm, windy day is best.

Upholstered furniture may also be shampooed, and the same rules apply. The chair or couch should be wheeled outside to dry, and care must be taken not to bring it in again too soon, as it may take longer to dry than a carpet.

Rubbing up the pile of the carpet with the fingers after wiping it as dry as possible.

CARE OF CARPETS

Carpets displayed in a showroom conjure up visions of comfort and colour in the home. However, they are an expensive item of furnishing, and the aim of the methods of treatment described in this article is to extend their period of service as much as possible.

Soapless Detergents

If a petroleum-base liquid soapless detergent is used, the method is very similar to that for other shampoos. Unless detailed instructions for its use as a carpet shampoo are given, use the detergent with tepid water in the proportion of about a pint to a gallon. (This solution is made stronger than would be used for general cleaning so that the carpet shall not be made too wet.)

Put the detergent in a bucket or bowl first and then add the water, stirring vigorously to form as good a lather as possible. If the colours of the carpet tend to run when wet, add a small quantity of acetic acid (or vinegar if the carpet is dark)—about 1 tablespoon to a bucket of mixed shampoo. Then use the lather as described for the soap shampoo, rubbing it on and wiping it off, but omitting the final rinse with vinegar water. These detergents are very good and are less alkaline than even neutral soap, so this last application of vinegar is not needed, as they contain practically no alkali to be neutralised.

Removing Stains

If the carpet carries any stains, they should be removed before it is shampooed according to the directions given in the article "Removing Stains from Materials which Cannot be Washed", by Evelyn E. Moore, on page 297 of the March, 1950, "Journal".

The article "Removing Stains from Washable Materials" on page 193 of the February, 1950, "Journal" may also be helpful, though a carpet is not strictly "washable" in the sense implied there. Here are further hints on removing stains from carpets:—

Acids (for example, lemon juice, vinegar, and some medicines) may change the colour of the dye and, if not removed or neutralised at once, may weaken the fibres. Even a dilute acid becomes more concentrated as it dries and may fade the dyes badly. As soon as possible sponge the stain with warm water, then sprinkle baking soda or ammonia over it. Baking soda froths and bubbles when it comes into contact with the acids. When the bubbling has stopped wipe the stain again with water. If the acid was strong, repeat the treatment—if necessary, several times. Finally rub the carpet as dry as possible with a dry cloth.

Furniture polish: Apply equal parts of colourless methylated spirit, acetone, and glacial acetic acid (99 per cent.), all of which are available from a chemist. Begin with a ring round the stain and work inward to prevent a ring mark showing afterward.

Glue: Most glues are soluble in water when fresh, but if thoroughly dried, they are often difficult to soften. Sponging at once with warm water should remove most glues. If it does not, try dilute acetic acid; vinegar might do if the carpet is dark enough not to be marked by the vinegar. Then sponge the stain again with warm water and dry the carpet as thoroughly as possible.

Creamy milk: To remove the cream sponge the stain with carbon tetrachloride from the outside in and allow it to dry. Then sponge it with warm water to remove the milk, and rub the carpet dry.

Iodine: Sponge the stain with denatured alcohol, then shampoo it as in the directions given. If the carpet is grubby, shampooing one piece may leave a cleaner patch, necessitating the shampooing of the whole carpet to match.

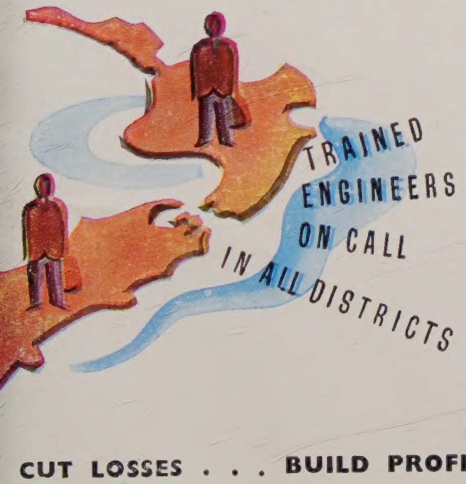
Shoe polish: Sponge the stain with turpentine, wood alcohol, or carbon tetrachloride. If this is ineffective, rub the stain with lard, leave it for an hour or two, then remove the lard with carbon tetrachloride, and shampoo the carpet.

Soot: Pass a vacuum cleaner lightly over the soot, being careful not to touch it if that can be avoided. Alternatively, brush the worst of it very lightly into a pan and cover the rest with an absorbent such as fuller's earth, powdered starch, cornflour, or salt. Brush this lightly off into a pan as it becomes soiled. Then, if necessary, sponge the stain with carbon tetrachloride or shampoo it.

The primary rules for removing stains are to treat them as soon as possible after they have been formed and to carry out the treatment with care. In fact, in removing stains, giving the carpet its daily or weekly cleaning, or shampooing it, the watchwords should be care and common sense. Only then can a carpet be expected to lead a long and useful life, giving its utmost toward increasing the luxuriousness of the home.

Printed by Blundell Bros. Ltd. (The Evening Post), Wellington—30491

To market . . . to market . . . to get a fat cheque . . .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SPECIAL RECOMMENDATION: IF YOU WASTE NO TIME YOUR COOL STORE CAN STILL BE IN OPERATION THIS SEASON.

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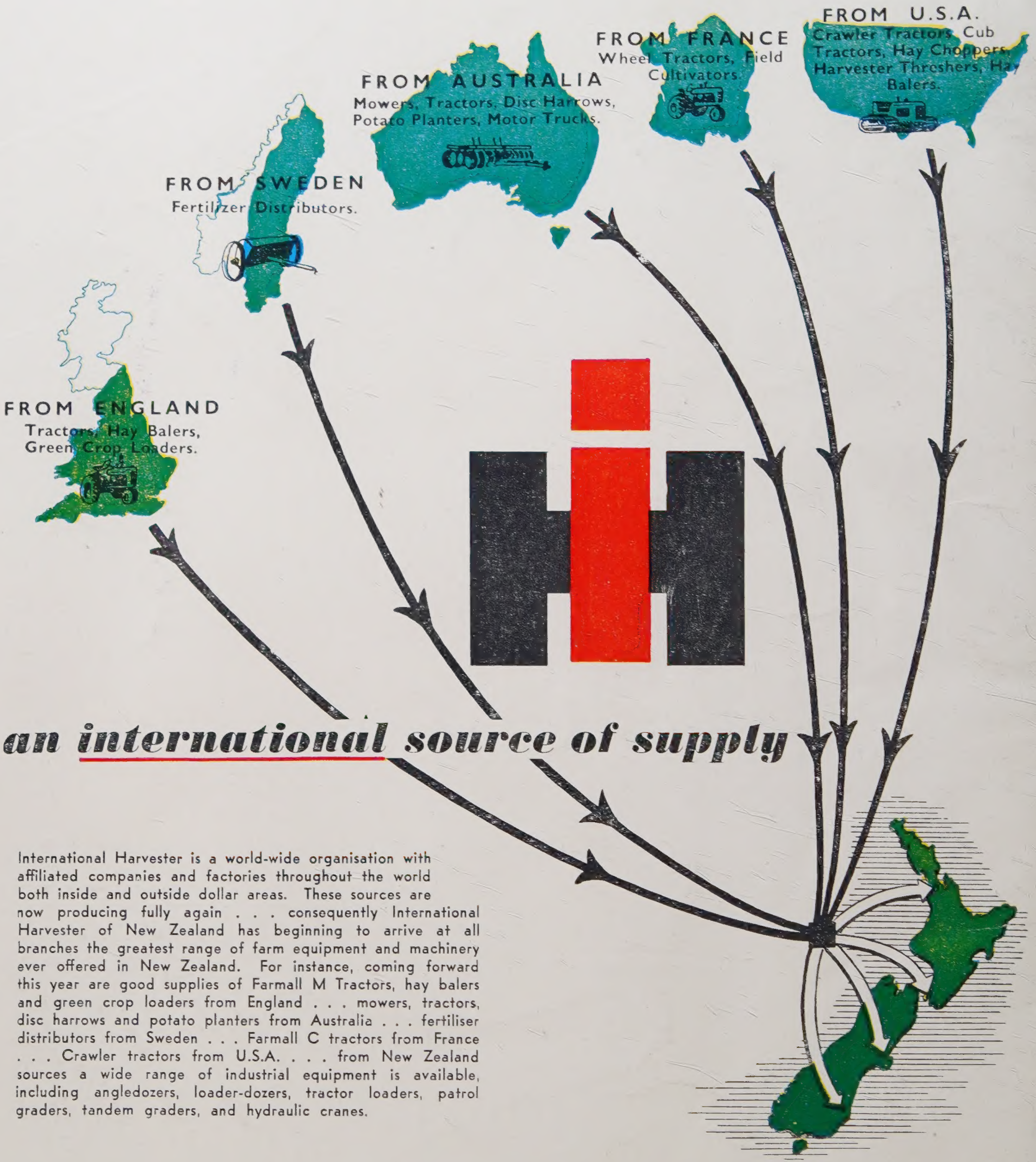
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